66

MAR 24 1925

THE REFINER AND NATURAL GASOLINE MANUFACTURER

In This Issue

Technical Subjects brought large crowd to Western Petroleum Refiners meeting in Kansas City. The Convention complete in this issue.

The Important part Treating plays in refinery operation. A discussion by Dr. C. K. Francis before W. P. R. A.

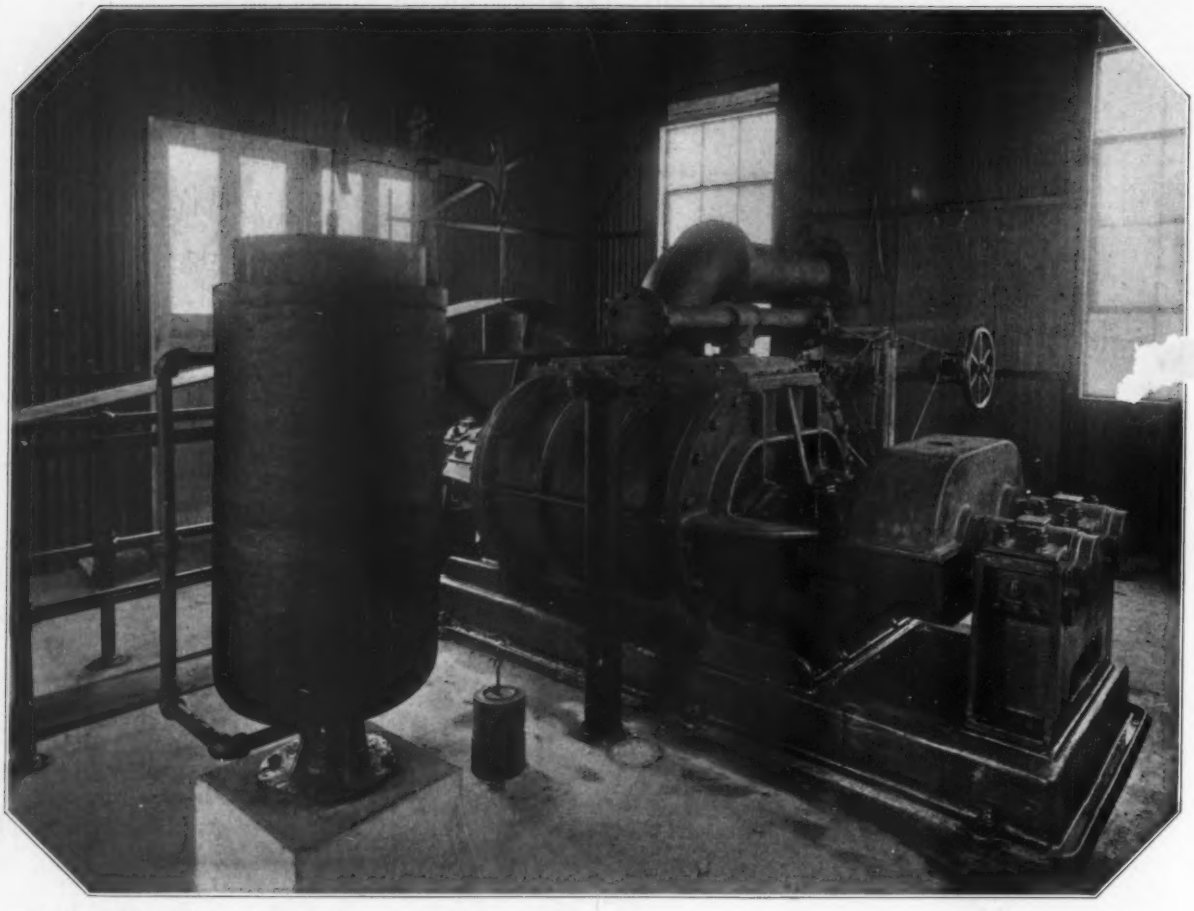
Corrosion in Refineries, its Cause and Prevention. By F. W. L. Tydeman, Superintendent Roxana Petroleum Corporation

History of Cracking and success of present methods. By George A. Burrell

Electricity Solves Fuel Supply at Oklahoma Gasoline Plant. How one company has met a serious problem. By Grady Tr.p'ett.

Vol. 4 No. 3 MARCH, 1925 $1.00 Per Year

With the Magnolia at Beaumont



Roots No. 8 Gas Pump in service at Lakehurst, New Jersey used to deflate the Shenandoah. The Helium Gas is taken from the huge bag at the rate of 100,000 cubic feet per hour and then pumped to the holder, 2500 feet away.

Unusual Service Requires Dependable Equipment

In choosing a Roots Rotary Gas Pump for deflating the Shenandoah, Government Engineers undoubtedly considered the fact that Roots Pumping Equipment has been rendering efficient and economical service continuously for a period of sixty-six years. Proven equipment is always their preference.

Refiners, who need this type of equipment, cannot err when buying equipment that is chosen where human lives are dependent on its continued operation.

Throughout the petroleum industry, where service is severe and economy essential, you will find Roots Equipment.

ROOTS

You should have the fo'lowing bulletins in your files:

113—Roots Rotary Pumps.

108—Roots Rotary Gas Pumps.

111—Roots Pos'tive Displacement Gas Meters.

118—Engineering Tables.

Just ask the nearest office for them.

The P.H.& F.M. ROOTS CO.

DEPT. 10

CONNERSVILLE, IND.

Chicago Office 130 S. Michigan Ave.

New York Office Room 800-120 Liberty St.

The same duty in almost half the length

The G-R Twin Heat Exchanger

is only a little more than half the length of a single unit designed for the same duty.

This means a more compact apparatus, with less expansion and resulting strains on piping connections, smaller space required for tube bundle removal, and high salvage value because of ease of disconnecting, transporting and re-erecting at new locations to meet changing conditions.

And these are only part of the advantages of the G-R Twin Heat Exchanger. This unit, used for interchanging heat between crude oil feed stock and still bottoms, cold water and hot oil, feed stock and hot still vapors, etc., will speed up your refining operations and reduce your refining costs.

Send the Coupon for Complete Information

THE GRISCOM-RUSSELL COMPANY

2135 West Street Building, New York

Philadelphia	Chicago	St. Louis	San Francisco
Boston	Cleveland	Kansas City	Los Angeles
Rochester	Detroit	Charlotte	Seattle
Pittsburgh	Milwaukee	New Orleans	Denver
Columbus	Minneapolis	Houston	Salt Lake City
	Indianapolis	Dallas	

For Canada: Riley Engineering and Supply Company, Ltd., Toronto

Griscom-Russell

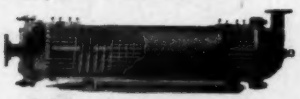
Heat Transfer Apparatus

Note these other G-R units for lower refining costs

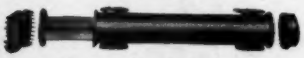
G-R Sectional Condenser
for condensing hydrocarbon vapors and other vapors. Can be used either as a standard or reflux condenser. The sectional arrangement permits using as a condenser and heat exchanger in one set or to obtain a different cut from each section. Described in Form 198.

Mineral Seal Oil Heat Exchangers
A compact, twin exchanger with strict counter-current flow to promote maximum rate of heat interchange. Described in Form 207.

G-R Vaneflo Gas Cooler
for cooling casinghead or natural gas. Can be used as inter-, after-, or precooler in absorption and compression type natural gasoline plants. Has low pressure loss and exceptional efficiency. Described in Form 208.



G-R Jacket Water Cooler
Uses any source of raw water to cool the jacket water from oil and gas engines and compressors. The famous Multiwhirl Cooler—over 2000 in operation in every liquid cooling service. Described in Form 209.



G-R Gasoline Condenser
for condensing natural gasoline vapors in casinghead gasoline plants. Can also be used as a knockout box or fractionating tower control section with particularly close control of the end points. Described in Form 210.

The Griscom-Russell Company,
2135 West Street Bldg, New York
Please send information on

- ☐ Twin Heat Exchanger
- ☐ Sectional Condenser
- ☐ Mineral Seal Oil Heat Exchanger
- ☐ Vaneflo Gas Cooler
- ☐ Jacket Water Cooler
- ☐ Gasoline Condenser

Name . .....

Address . .....

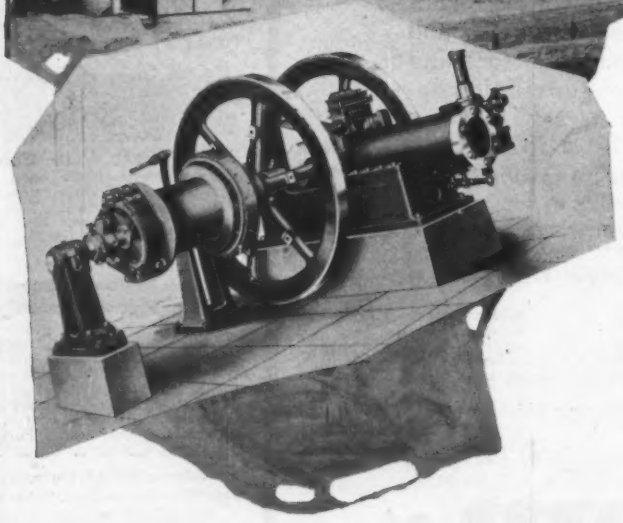
.....

.....

R3-25

WESTERN

WESTERN MACHINERY COMPANY



Efficient Dependable POWER

Western supremacy among internal combustion engines for oil country service results directly from the perfect co-ordination in practical service of those features embodied in every "Western" Engine which are essential to efficient, dependable power—efficiency, economy in operation and upkeep, absolute dependability under all conditions, adaptability to the service involved, complete utilization of floor space, and successful operation in conjunction with other types of power machinery—each to the highest degree attainable and in direct proportion to the others.

The "Western" Oil Field Engine and Reverse Gear, and one of the deep well fields where these engines are pumping oil efficiently and economically from depths which long have been considered beyond the scope of this type of power unit. The records of performance and operating costs of many of these engines are available and will be furnished on request. Mention Bulletin No. 40.

Western Machinery Company

General Offices and Factory:
903 North Main St., Los Angeles, California

San Francisco Offices and Factory:
Eighteenth and Alabama Streets

Tulsa, Oklahoma — Bakersfield, California

Tell them where you saw the ad

Quick~ Easy and Thorough Cleaning

THE motors of Lagonda Cleaners are powerful, making for fast work. They are an exact fit in the tube so that they will not pass through until all scale deposits have been removed. The cutting heads are easy to take apart for replacement of worn cutters.

The illustrations to the right show a few of many services in which various types and sizes of Lagonda Cleaners are used in the Oil Refinery.

Let us supply you with Catalogs, prices and full information on machines to take care of your cleaning needs.

The Lagonda Mfg. Co.
SPRINGFIELD, OHIO.
FUEL SAVING SPECIALISTS
NEW YORK, CHICAGO, PHILADELPHIA, BOSTON, PITTSBURGH, CLEVELAND CINCINNATI, DETROIT, SYRACUSE, BALTIMORE. ST. LOUIS, KANSAS CITY, DENVER, DALLAS, ATLANTA, SAN FRANCISCO, MONTREAL, LONDON.

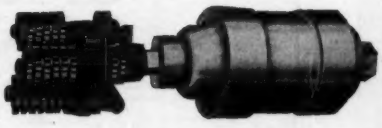
Lagonda Tube Cutters, Condenser Cleaners, Cap and Header Reseaters, Cleaner Feeding Device

X-1385

for oil still tubes

Air driven cleaner with special long surface cutting head for removing carbon deposit from oil still tubes

for large pipes



This air or steam-driven cleaner is furnished in sizes 6 in. to 12 in.

for small tubes

This shows a special application of small cleaner for superheater tubes

for straight tubes

Cleaners with air or steam-driven motors or water-driven turbines in two styles

for curved tubes

Air, steam or water-driven cleaners, using universal joints and short motor, to go around bends

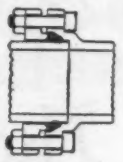
for fire tubes

This air or steam-driven cleaner successfully vibrates the scale from the outside of the tubes

Lagonda Cleaners

Tell them where you saw the ad

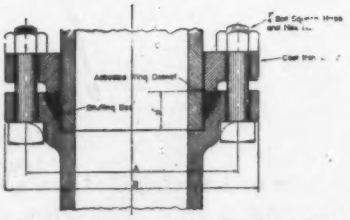
SIMPLEX CAST IRON CONDENSER PIPING



"ONE FLANGE IS LOOSE"

Settles the Rust Question

Progressive refineries now secure the durability of cast iron pipe in their condenser coils without the disadvantage of standard flanged pipe construction. Our Simplex joint, using a triangular shaped, endless asbestos gasket, is the secret. It is fully described and illustrated in our Catalog No. 55. Your copy is ready to be mailed upon receipt of your request.



Cross Section Assembled Simplex Joint

Do you know why cast iron resists corrosion so much more than other ferrous metals? Our Bulletin No. 44 explains it.

Write for Simplex Condenser Catalog Number 55

AMERICAN CAST IRON PIPE COMPANY

General Offices and Foundry: Birmingham, Ala.

Branches at
Dallas, Kansas City, San Francisco, Los Angeles, Chicago, New York,

Write Also for information on Our Prepared Joint Cast Iron Pipe for Oil Lines

A COMPLETE SERVICE IN

"John Crane"

FLEXIBLE METALLIC PACKING

Refiners: Attention!

There is a special **"JOHN CRANE"** Metallic Packing for every service:

Air Rods
Steam Rods
Ammonia Rods
Hot Tar
Residuum Oils
as well as crudes
and distillates.

A New Metallic Packing for Centrifugal Gasoline Pumps

Where pumps handling gasoline, naphtha, benzol, etc., must run cool and the element of risk from explosion must be considered, "JOHN CRANE" Style 110 is being used extensively by a number of large refineries.

This new packing consists of continuous ribbons of soft babbitt foil wound over a braided asbestos core. It has ample resilience and flexibility, yet provides a metallic wearing face which reduces friction and wear to a minimum and gives long satisfactory service. Can be cut with a knife and is quickly and easily installed. In coils 10 feet long, sizes up to 1¼ inch.

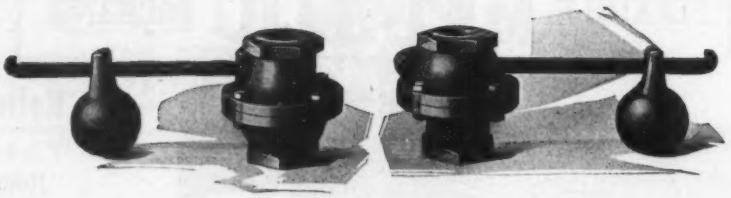
Write regarding your services. Stock of all styles in the following oil centers

Crane Packing Company

Casper Supply Co., Casper
W. H. Steigerwald Co., 617 Washington St., Houston
217 Water Street, Pittsburgh
Pacific Mill & Mine Supply Co., 310 E. Third St., Los Angeles and 616 Mission St., San Francisco
1808 Cuyler Avenue, Chicago

Tell them where you saw the ad

Titusville
Safety *and* Vacuum Valves



A heavy cast iron valve for use on oil stills, made with brass valve and seat, the result of over a half century of experience in designing and manufacturing equipment and supplies for the oil fields.

The Safety Valve can be set to any pressure under five pounds; the Vacuum Valve can be adjusted to a maximum vacuum of about two pounds.

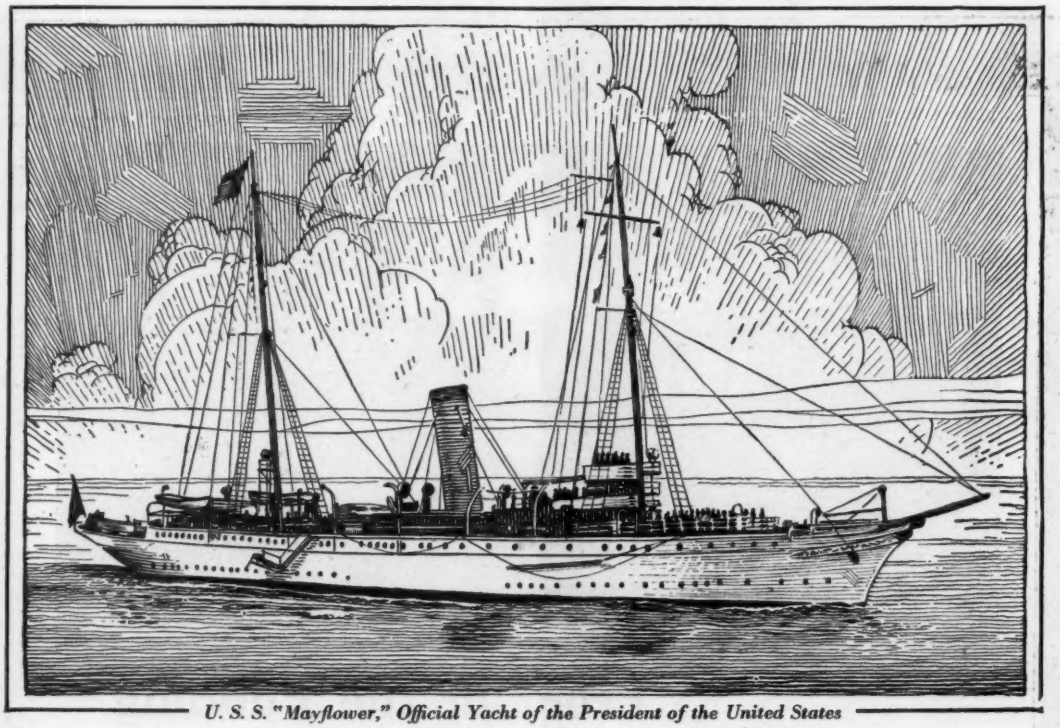
Complete specifications and prices on request

The TITUSVILLE IRON WORKS Co.
TITUSVILLE - PENNA.

TITUSVILLE EQUIPMENT
Oil Country Boilers
Steam Drilling Engines
Tico Gas Engines
Flapper Valve Pumps
Pumping Powers
Twin Drilling Engines
Rotary Machines Rotary Drawworks
Swivels Slush Pumps
Crown Blocks
Traveling Blocks
Rotary Drilling Specialties

TITUSVILLE OIL COUNTRY MACHINERY
RUGGED - ENDURING

AFFILIATED COMPANIES FOR DISTRIBUTION
For Mid-Continent, Eastern, Western and Coastal Fields:
The Continental Supply Co.
For California:
The Republic Supply Company of California
For Export:
The Continental Well Supply Company,
No. 2 Rector Street,
N. Y. City



U. S. S. "Mayflower," Official Yacht of the President of the United States

In the Ship of the Presidents

THE boiler furnaces of the presidential yacht "Mayflower" have been insulated with Sil-O-Cel C-22 brick. Now the boiler room is cool. The heat of the fires is kept inside the boiler; kept at work generating useful steam. Barriers of Sil-O-Cel C-22, 2½ inches thick in the steel-jacketed walls and 4½ inches in the base, make them virtually heat tight, as waste-proof as practical construction can be.

This high-temperature insulation reduces heat losses by radiation as much as seventy per cent. It weighs less than a twentieth as much as fire brick of equivalent insulating value. And it is unharmed by temperatures as high as 2000° Fahrenheit, a degree of heat seldom reached behind suitable refractory linings.

Sil-O-Cel insulation keeps heat in the harness. Properly installed in stationary boiler settings, kilns, annealing ovens, furnaces and other heated equipment, it returns its cost in about a year in fuel savings alone. Where accurate temperature control is important, it often pays for itself in a few months' time. And it serves indefinitely.

Sil-O-Cel insulation is a standard Celite *barrier to industrial waste.* There are important places in practically every industrial plant where it will pay big dividends in conservation of heat and improved temperature control. Celite service is always at your command to help you find them. Write for bulletin **R-3.**

CELITE PRODUCTS COMPANY

NEW YORK - 11 BROADWAY. CHICAGO - 53 W. JACKSON BLVD.
LOS ANGELES - VAN NUYS BLDG. SAN FRANCISCO - MONADNOCK BLDG.
OFFICES AND WAREHOUSES IN PRINCIPAL CITIES
CELITE PRODUCTS LIMITED, NEW BIRKS BLDG., MONTREAL, CANADA
CELITE PRODUCTS CORPORATION, WINDSOR HOUSE, LONDON, S.W.1, ENGLAND

SIL-O-CEL

TRADE MARK REGISTERED U.S. PATENT OFFICE

HEAT INSULATION

Tell them where you saw the ad

The first photo of UNITED FUEL GAS CO.'S NEW LEWIS COMPRESSOR STATION Ten 485 B. H. P. Cooper gas engines, operating as twins, drive Cooper compressors.

"Proof of the Pudding"

Would you believe us if we told you that Cooper four-cycle gas engines are operating on less fuel, require fewer repairs and give more continuous operation than any other gas engines built today? Are you convinced when operators from every oil and gas field in the country say they would rather operate Coopers?

Engine builders and operators, not meaning to exaggerate, but influenced by individual enthusiasm, may easily misstate the real facts.

For that reason we are always reluctant to make such statements when we can convey the same truths much more convincingly by telling you that such companies as the United Fuel Gas Co. in West Virginia, now operating 50,000 B.H.P. in Cooper engines, continue to install Coopers.

THE C. & G. COOPER CO.
MT. VERNON, OHIO

1605 Kirby Bldg., Dallas. 504 Kennedy Bldg., Tulsa
439 E. 3rd St., Los Angeles.

COOPER

OFFICES AT
2002-350 Madison Ave., New York
453 First National Bank Bldg., Chicago
215 Atco Bldg., Tulsa
1201 Haas Bldg. Los Angeles
212 W. T. Waggoner Bldg., Fort Worth

The REFINER and NATURAL GASOLINE MANUFACTURER
Published Monthly by GULF PUBLISHING Co.
Houston, Texas

For men engaged in the operating branch of the refining and natural gasoline business.

Vol. 4 March No. 3

R. L. DUDLEY, President and Publisher

Price .....$1 per year

Advertising rates upon application to nearest office.
Copyrighted by the Gulf Publishing Co., 1924

Technical Subjects Make Hit With Refiners

Plant men swell crowd at Kansas City meeting which proves to be biggest event yet held by W. P. R. A.

By Grady Triplett
Staff Representative

Kansas City, Mo.—What earned the rating of the best convention of the Western Petroleum Refiners' Association came to a close here the night of March 5, with a banquet. It ended three days of general and executive sessions.

The large attendance and the intense interest in the open programs were the outstanding features of the success of the meeting. That the decision to have group sessions for the discussion of technical sessions was a departure worthy of converting into part of each annual meeting was evident from the turn of this part of the program. These technical sessions brought men to the convention, who otherwise would not have come. Once there, they made it a point to sit through the whole session and then to take part in the discussion that followed each paper.

That the general bright outlook of the whole petroleum industry had something to do with attendance was evident from the lobby conversation in the hotel Muehlebach, where all sessions were held. Refiners are bent on making the most of conditions which

Seated, left to right—George D. Locke, vice president Barnsdall Refining Co., Chicago; J. H. Miller, president Miller Refining Co., Kansas City; H. T. Ashton, vice president Lubrite Refining Co., St. Louis; A. F. Garrett, sales manager Tidal Refining Co., Tulsa; M. G. Billingslea, White Star Refining Co., Detroit (representing H. B. Earhart, president); N. H. Martin, vice president Texhoma Oil & Refining Co., Wichita Falls; A. L. Derby, president Derby Oil Co., Wichita.

Standing, left to right—G. G. Woodruff, vice president Roxana Petroleum Co., St. Louis; Richard Airey, president Asiatic Petroleum Co., New York (not a director); F. A. Pielsticker, vice president Skelly Oil Co., El Dorado, Kansas; Fayette B. Dow counsel Western Petroleum Refiners' Association, Washington; C. L. Henderson, vice president Vickers Petroleum Co., Wichita, Kansas; Elliott Jones, president Elliott Jones & Co., San Antonio; H. K. Davis, statistician Western Petroleum Refiners' Association, Tulsa; W. E. Perdew (not a director).

Seated, left to right, (back row)—Roy B. Jones, president Panhandle Refining Co., Wichita Falls; O. D. Robinson, vice president Transcontinental Oil Co., Pittsburgh; E. W. Goebel, secretary-treasurer Kansas City Refining Co. Kansas City; C. C. Peppers, president Peppers Gasoline Co., Enid, Okla.; V. E. Bolene, manager Bolene Refining Co., Enid, Okla.; J. L. Walsh, sales manager Transcontinental Oil Co., Kansas City; Sam Collins, vice president Marland Refining Co., Ponca City, Okla.

Other directors of the association are Weston Atwood, manager De Leon Pipe Line & Refining Co., De Leon, Texas; D. E. Buchanan, vice president Chestnut & Smith Corp., Tulsa; Walter K. Campbell president Western Oil Corp., Tulsa; O. L. Cordell, vice president, Waite Phillips Co., Tulsa; L. R. Crawford, vice president Producers & Refiners Corp., Denver; H. B. Earhart, president White Star Refining Co., Detroit; D. L. Gilliland, manager International Ardmore Refining Division, Pure Oil Co., Tulsa; John L. Gray, vice president Shaffer Oil & Refining Co., Tulsa; C. L. Mayhall, vice president Imperial Refining Co. Tulsa; D. W. Moffitt, vice president Mid-Continent Petroleum Corp., Tulsa; H. A. Trower, sales manager Phillips Petroleum Co., Bartlesville; R. R. Irwin, vice president White Eagle Oil & Refining Co., Kansas City; P. E. Landsittle, sales manager Globe Oil & Refining Co., Tulsa.

BOTTLE TIGHT

An ideal still would be made from a continuous sheet of steel without any necessity for joining ends or seams.

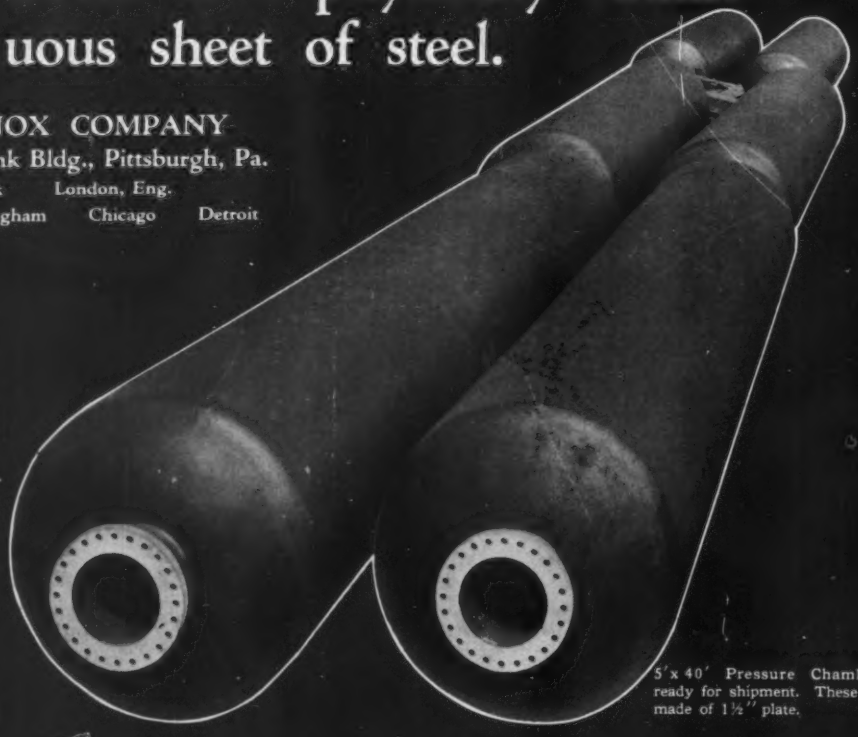
THE BLAW-KNOX FORGE AND HAMMER WELDING PROCESS makes all joints one with the original plate. They are jointless when complete.

The structure of a BLAW-KNOX STILL is a physically continuous sheet of steel.

BLAW-KNOX COMPANY
624 Farmers Bank Bldg., Pittsburgh, Pa.
New York London, Eng.
Baltimore Birmingham Chicago Detroit

BLAW-KNOX

BLAW-KNOX PRODUCTS
STEEL FORMS For Concrete Construction
ROAD BUILDING EQUIPMENT
GLAMSHELL BUCKETS
STEEL BUILDING (Sectional)
TRANSMISSION TOWERS
STRUCTURAL STEEL
PLATE WORK
WATER-COOLED APPLIANCES For High Temperature Furnaces
SHEET and TIN and STRIP and WIRE MILL EQUIPMENT
FORGE and HAMMER WELDING



5'x 40' Pressure Chambers ready for shipment. These are made of 1½" plate.

SEAMLESS

Tell them where you saw the ad

promise better than those of any year for the past four.

At the close of his talk on "Relation of Sales Department to Credit Department," F. L. Miller, vice president of the Miller Petroleum Company, suggested that a sales managers' division of the association be formed. This resulted in the passage of a motion, authorizing the president of the association to name a committee of five, who will outline the purposes of such an affiliated body, bringing the plan before the Board of Directors for approval.

Ratification of the resolution of the National Refinery Credit Men's association on limiting the time of discounts to the period of turnover on gasoline passed an open session of the association, after it had been introduced by M. D. Creel, credit manager of the Marland Refining Company. He presented it at the close of his speech on "The Problem of Credits."

It was brought out that approval of the resolution did not mean that members of the Western Petroleum Refiners' Association will adopt immediately the plan of limiting discounts to the period of turnover. Instead approval meant only that the association is in accord with the move to so limit credit.

The sessions most widely attended were those of the second day, in charge of the manufacturing committee of the association. C. L. Henderson, vice-president of the Vickers Petroleum Co., presided. Both the morning and afternoon were devoted to this. During the morning the session was adjourned so members of the association could hear the inaugural address of President Calvin Coolidge over radio. The instrument was installed by the Kansas City Star.

The technical session brought before the convention Dr. C. K. Francis, general manager of the Braden Company, on "Treating"; Dr. F. W. L. Tydeman, of the Roxana Petroleum Co., on "Corrosion in the Petroleum Refinery"; W. A. Peters of E. B. Badgers' Sons Co., on "Fractional Distillation in the Petroleum Industry"; H. W. Camp, general superintendent Empire Refineries, Inc., on "Development in Design and Operation in Topping Plants"; and Ray Miller, now engineer of the Safety Council of the Mid-Continent Oil & Gas Association, on "Safety Work in Petroleum Refineries."

Because of these subjects, the convention in Kansas City drew scores of engineers, superintendents, chemists and other technical men, who otherwise would not have attended. These helped to swell the registration to 355. They came to hear the papers and to discuss the thought brought in the papers. Following each speech, there was free discussion of the type that carried weight.

Other technical subjects came before the body at the breakfast the final day of the convention. H. L. Shoemaker, assistant chief engineer of the Standard Oil Co. (New Jersey) presented a paper on "Fire Prevention," while T. T. Gray offered a paper on "Refining Cracked Products in the Vapor Phase," which was read by M. R. Mandelbraun, a co-author.

Evidence of the success of the activities of the association during the past year came with the re-election of all officials. These are F. A. Pielsticker, vice president of the Skelly Oil Co. of El Dorado, Kansas, president; Pat M. Miskell, vice president of the Refineries, Inc., Tulsa, first vice-president; Roy B. Jones, president Panhandle Refining Co. of Wichita Falls, second vice president; George D. Locke, vice president of the Barnsdall Refining Co. of Chicago, third vice-president; Howard Bennette of Tulsa, managing director.

The following executive committee was named from the board of directors, listed with an accompanying picture, H. T. Ashton, vice president of the Lubrite Refining Co. of St. Louis; D. E. Buchanan, vice president of the Chestnut & Smith Corp. of Tulsa; Sam Collins, vice president of the Marland Refining Co. of Ponca City; C. L. Henderson, vice president of the Vickers Petroleum Co. of Wichita, Kansas; Elliott Jones, president of Elliott Jones & Co. of San Antonio; N. H. Martin, vice president of the Texhoma Oil & Refining Co. of Wichita Falls; and J. H. Miller, president of the Miller Petroleum Co. of Kansas City.

Seek Change in Gasoline Specifications

Kansas City, Mo.—Efforts to have the Federal Specifications Board revise its scale on motor gasoline have been undertaken by the Western Petroleum Refiners' Association so the loss in output caused by the removal of cotton from the bulb of the thermometer will be corrected. Removal of the cotton from the bulb took place in 1923.

In bringing this before the recent convention of the association here, Walter Miller pointed out that it tends to make the reading of the thermometer from 3 to 6 degrees higher for the whole distillation range. This means that U. S. Motor gasoline is 4 degrees lower in boiling point than gasoline made on the same specification before removal of the cotton.

A letter from offices of the association to the Federal Specification Board takes up the position of the members of the association in detail:

"At a meeting held by your body in the fall of 1923, the method of making the distillation tests on motor gasoline was changed so as to eliminate the use of cotton on the thermometer. The use of cotton on the thermometer had been general and a part of the official specifications for many years prior thereto. No change was made in the specification set for U. S. Motor gasoline.

"It is generally conceded that the elimination of the use of cotton on the thermometer bulb tends to make the reading of the thermometer from three to six degrees higher through substantially the entire distillation range, and a number of the members of the Western Petroleum Refiners association, who have investigated the subject, believe that there is an average difference, stated conservatively, of four degrees. Granting that this is correct, motor gasoline made in accordance with the new method to meet the same temperature specifications is therefore substantially four degrees lower in boiling points than the gasoline made under the former methods of employing cotton on the bulb.

"While it is a difficult point to determine exactly, there is no question but that the lower the end point of the gasoline made, other conditions being aqual, the lesser the yield obtained. Those members of our association who have worked on this problem substantially agree that this difference in distillation points means a reduction in yield of straight run gasoline from the crude oil of approximately one percent, and also reduces in similar proportions the yield of gasoline from cracking processes. Based on gasoline this would mean a reduction in gasoline production of from two to four percent.

Against Conservation

"It is not believed by the members of our association that there is any necessity for an improvement in the quality of motor gasoline so far as distillation points are concerned. We know of no change in motor design which necessitates such a step on the part of gasoline manufacturers, the work of designers and engineers being directed to obtain results in other directions.

"We also believe that the lowering of the boiling points is contrary to the principle of the conservation of petroleum products, for the furtherance of which the Federal Oil Conservation Board was recently appointed by the President. It necessitates the transfer of a substantial potential gasoline fraction into products of lower intrinsic value.

"The main reason given to some members of our association by some members of the A. S. T. M. committee and the Federal Specifications Board for not changing the specifications at the time the method was changed, was that at that time there was a tremendous over-production of gasoline and that the public might have believed, if the distillation points were raised, that

(Continued on page 18)

Many Methods Used in Treating Operation

As demand for higher quality product increases more knowledge of various systems is being sought

From a Paper read before the Western Petroleum Refiners Association at Kansas City

By Dr. C. K. Francis

Among the foremost problems of the petroleum industry there is probably none more important than that of purity. In using the word purity I refer specifically to the quality of its commercial products. The remarkable increase in demand, within the last twenty years, for all petroleum products has been so great that the matter of quality up to the present time has, to some extent been overlooked. This has been especially true of gasoline, which from a waste product, has become the controlling factor in petroleum refining. The foremost question before the petroleum refiners twenty-five years ago was: What shall we do with this light stuff? Its name was not fixed; some called it naphtha, others gasoline. The question was changed fifteen years later to: How can we produce more gasoline?

Demand For Quality

Several methods for the increase of volume of gasoline were perfected with such success that a demoralization of the market resulted. This condition is no doubt passing but the demand for quality has steadily advanced. The specifications controlling quality have become more numerous and exacting each year. From gravity and color specifications we have advanced to distilling with fractional percentages initial end point, vapor tension, gum forming and corrosion tests.

You will recall that a short time ago, when the market was short on gasoline, almost anything in the gasoline class could be sold. The refiners were rushed and the consumer was not critical. A condition existed which may be illustrated by the story of the man who was complaining that his house was infested with rats. His friends asked, "Have you fed them rat biscuits?" He replied, "Why, no, if the food we eat is not good enough for them, they can go to hell!"

The attitude of some refiners was that the public could not require them to make a uniform product, as to quality. This position has been found to be erroneous, and competition is rapidly compelling better products to be marketed. What may be said of gasoline applies equally well to kerosene and other petroleum products.

The refinery operations which are confined to the purification, after the separation from the crude, are filtering and treating. The treating process may, and often does, include more or less filtering, so for the purpose of this paper, filtering shall be considered a part of the treating operation. The purification of petroleum distillates has from the very early days of the industry been accomplished by the use of alkali—usually sulphuric acid and caustic soda.

When oil was discovered in Ontario and northern Ohio, about 1868, the ordinary refining treatment with acid failed. The products from this oil had a very offensive odor, due to the large quantity of sulphur it contained, and the crude was commonly known as skunk oil. Pennsylvania crude was then selling for $2.25 a barrel, but the price of this crude rapidly declined to 10 cents and much of it was given away. No satisfactory method for purifying the products from this crude was found until about twenty years later when Frash perfected the copper oxide method. This method was probably the first to successfully introduce treating material into the still.

The usual method for treating gasoline, kerosene, lubricating oils and other products is commonly called the agitator process. The material is pumped into a specially constructed tank which is provided with means for mixing the liquids, and while formerly paddles and other devices were used, it is now the common practice to mix or agitate by means of compressed air. While the liquid is being agitated, sulphuric acid is added. The quantity of acid may vary from a fraction of a pound to six pounds per barrel of the product treated, when treating gasoline or kerosene. It may be necessary to use very much more for certain grades of lubricating oils. The quantity of acid varies according to the material and specific results desired.

The liquid is washed free from acid by showering water through it. Then, to be very certain that no trace of acid remains, and to remove some sulphur compounds, it is washed with an alkaline solution of caustic soda. It is often necessary to add lead and sulphur. The alkaline treatment is commonly known as sweetening. I shall speak of these more in detail.

Acid Treatment

After the acid and alkali treatment, the product is usually ready for shipment. Sometimes it may be necessary to redistill it. There are several combinations for applying the agitator process. I have simply given a brief outline of the general process. The method has had practically no satisfactory scientific explanation until quite recently. It was known that a sweet gasoline would go off test during storage. A good doctor test oil would become sour on rerunning. Often a treated product would contain more sulphur than the crude from which it was made.

Some objectionable results have been caused by under treatment with acid. This is not often true, because the treater believes in adding plenty of acid and almost constant supervision is required to keep down the acid expense. Many treaters, in their use of acid, remind us of the Irish carpenter who was asked: "Do you know how to make a Venetian blind?" "Sure," he replied. "Well, tell me how you would go about it." "Begorrah," he said, "I'd stick my thumb in his eye!"

Does Not Stand Up

An oil treated with acid does not stand up and much of the subsequent treatment is nullified. Consequently, the addition of excessive quantities of acid is really tempting. Hydrogen sulphide, mercaptans, and sulphur dioxide are usually the sulphur compounds responsible for the bad odor of certain gasolines and kerosenes. This may be particularly true of under treated fractions, those which have been rerun, and pressure still products. Hydrogen sulphide is a decomposition product of many animal substances. It is responsible for the bad odor of a stale egg. It finds its way into crude oil probably through the decomposition of organic material when the petroleum was formed. It is a gas and therefore passes off from the crude into the lighter distillates at low temperatures. The action of sulphuric acid and some sulphur compounds produces hydrogen sulphide. The proper contact with caustic soda and alkaline lead change it into other substances easily removed. However, some sulphur compounds do not react to the doctor test, so a product may contain sulphur and yet be sweet. Some of these substances are broken up by heat, and it is these that are often the cause of a sweet product becoming sour on being rerun. A proper study of the crude and the products from it, aids in formulating the required treating methods. The preparation of gasoline and kerosene by means of pressure stills introduced an interesting treating problem.

It was found that pressure distillates did not respond to the ordinary meth-

ods used for treating. The gasoline and kerosene was often of poor color, had an objectionable odor, contained an excess of sulphur, contained gum forming substances, frequently contained acid, and went off color in storage. The character of the original crude and the product charged to the pressure stills, of course, influence the properties of the distillate. Many combinations of acid and alkaline treating, together with distillation and filtering have been developed. Alkaline substances, introduced into the re-run still with the pressure distillate, have been found to be successful in many instances. Such material should decompose or evaporate at a relatively low temperature. Caustic soda, for example, has not proven satisfactory because the solid caustic is deposited in the still and causes damage to the still bottom through the formation of hot spots.

Method Some Use

Some refineries apply the full acid treatment, follow with a slightly alkaline wash, then re-run. The sweetening stage of the treating is applied to the overhead, which has been brought to boiling point specifications. This is logical, because when a petroleum product is fully treated and sweet to the Doctor test and then distilled, it will often become sour. This I have explained by the fact that many sulphur compounds decompose 250-350 degrees F. at low temperatures. A substance which is not darkened by the Doctor solution will, when decomposed, form other substances which do react with the Doctor solution. Therefore, when a distillate is to be redistilled, it is not advisable to apply the treating process in full before rerunning. It is usually better to give the full acid treatment, follow with a weak alkaline wash, to prevent any acid going into the still, then re-run. The re-run distillate should then be sweetened with plain alkali or with the lead sulphur as necessary.

The pressure still products are better treated in closed agitators and preferably of the continuous type. These products are more difficult to purify. Those color and gum forming substances are not present in the ordinary crude fractions. They are more easily produced in the presence of light and air than in darkness and when care is observed to exclude the light. The closed treating unit is to be preferred for the additional reasons of increased volume and less loss by evaporation. A continuous treater may be easily made from pipe and fittings. They have been found so satisfactory and so much superior to the open agitator that this well known symbol of petroleum refining will probably soon be discarded by many refiners.

The continuous movement of the stream from the still until ready for shipment is to be desired. This, when accomplished, means a great saving in operating costs. The sweetening of the light stream can be done by permitting it to pass through an alkali closed treater by gravity on its way to the storage tank. When such treaters are arranged in pairs, there need be no loss of time when one is shut down for cleaning or repairs. Dilution of the treating chemicals from water, coming over the distillate, will be prevented if a separating trap is placed in the condenser coils and thus direct the hot water to a soft water tank.

Advance Method

An advance in treating methods has been made in the so-called contact filtering process. This method has employed a special clay, also a very fine Fullers earth is being used. It is especially applicable to lubricating oils but no doubt may be applied with some modifications to kerosene and other light fractions. The contact process consists, briefly, in agitating the oil with the fine clay and acid at an elevated temperature in a closed tank. The mixing is done by paddles or some stirring device other than air. After a slight settling, the clay is removed by passing the oil through plate filters.

A step toward complete refining of the fluid between the still and the storage tank, has recently been accomplished in the barnsdall installation of the Gray process for treating pressure distillate. This process has an additional advantage in that it does away with the necessity for treating with sulphuric acid, always an objectionable and troublesome substance to handle. It is claimed that the method produces a bright and clear product which is free from many of the objectionable substances found in the ordinary acid treated pressure still gasolines and kerosenes.

The Gray treating process is very simple as to operation and apparatus. The vapors from the still are passed through a jacketed filter before they are cooled and condensed. The filter consists of an upright tank charged with 60/90 Fullers earth. The hot vapors from the still pass upward on the outside of the filter and thus maintain the Fullers earth at the temperature of the vapor stream; which will usually be between 350°-450° F. during the run. The hot liquids and vapors pass down through the filter. The heavier portions appear to select the color and gum forming compounds as they flow to the bottom of the filter. The purified material passes off near the bottom, to the condenser.

The process yields 65% water white product on the basis of the quantity of pressure distillate charged to the re-run still. This product is not ready to be marketed but must be sweetened.

In conclusion it may be of some interest to present some of the chemistry of the treating process. I have stated that until recently no satisfactory explanation had been made of just what takes place. Investigations in the research laboratories of the Standard Oil Co. (Indiana) and the University of Pittsburgh, have given us some very illuminating information on the subject. The principal substances acted upon during treating are hydrogen sulphile, previously mentioned and a class

(Continued on page 40)

Some of the members of the Western Petroleum Refiners Association in attendance at the Kansas City meeting.

Operators Oppose Change in Vacuum Control

Oklahoma Corporation Commission has matter under advisement following hearing on proposed regulator

Oklahoma City, Okla., March 17.—Oklahoma oil producers and manufac turers of natural gasoline went on rec ord here Monday against any change in present State regulations of the vacu um to be used in the old fields of the State. The occasion was a hearing be fore the State Corporation Commission in a case seeking to require that a sealed regulator be set on the vacuum line from each oil well to make it im possible for any operator to draw vacuum in excess of the figure set by regulations.

Farmer Filed Petition

The hearing resulted from a petition filed by C. H. Hyde of Alva, Oklahoma, once a member of the State Board of Agriculture and now an official of the Oklahoma Farmer's Union. He styled himself a "friend of the people," hav ing no interest other than the conservation of petroleum resources.

On taking the stand he said he believed it would be a good thing if the State would require the sealing of vacuum regulators, as it would prevent any operator from pulling excessive vacuum against a property, while other operators kept their vacuum within the stipulated figure. He qualified this with the provision that installation of such regulators should not be excessive in cost.

When questioned he said he had a friend, who had invented a regulator capable of being set at a maximum figure, after which it could be sealed. He explained that he had no interest in the patent or in its manufacture.

Much of the hearing was devoted to the operation of regulators on vacuum lines, the effect of pulling excessive vacuum on one property and the methods oil companies use to determine what vacuum neighboring producers are pulling.

Not Necessarily Harmful

Contrary to the general impression, practical men gave it as their opinions that pulling a vacuum at an excessive figure is not necessarily detrimental to adjoining production. Furthermore, they admitted they kept themselves posted on the operation of adjoining properties by frequent inspections of both equipment and records.

As for the advisability of setting sealed regulators, each man on the stand said he could see no benefit from it, while he did believe it would increase the cost of operating leases through loss of time and the buying of new equipment.

The following resolution was read into the record by Harry H. Smith, Secretary of the Mid-Continent Oil and Gas Association:

Smith Reads Resolution

"A general meeting of the Oil and Gas Producers in the State of Oklahoma, members of the Mid-Continent Oil and Gas Association, held on the twelfth day of March, 1925, having under consideration the proposed order of the Corporation Commission of the State of Oklahoma requiring the installation of relation devices in connection with the use of vacuum on oil and gas wells;

"Resolved that it is the unanimous opinion of this meeting that it is not advisable to require operators of oil or gas wells in this State to install regulating devices to limit or control the degree of vacuum to be applied, and that the reasons for the conclusion are as follows:

First—The proposed order as indicated by notices would be too broad in its terms in that it would place an unnecessary financial burden on all such operators and in every case and pool, although in the majority of instances, at least, there would be no need for regulating devices.

Second—The end sought by the proposed order would not necessarily be accomplished in that operators disposed to violate any vacuum order might do so regardless of existence of regulating devices.

"The meeting further takes the position that the jurisdiction over vacuum as now exercised by the commission represents the limit of justifiable regulation in that regard and that the requirement of regulating devices would be going a step too far in that the authority of the commission and the responsibility of the operator is served when a vacuum order is made and is complied with by the operator, regardless of whether he uses regulating devices or not, or any particular kind of devices. In other words the commission now has jurisdiction to enforce any valid order it makes by fine or otherwise; we do not think it advisable or permissible for the commission to attempt to prescribe the means by which an operator shall conduct his business to comply with any particular vacuum regulation that may be imposed."

This resolution was concurred in by the Association of Natural Gasoline Manufacturers, A. V. Bourque, its secretary, bringing this before the Commission. Under existing rules, the Corporation Commission fixes the maximum vacuum to be applied to an oil field by getting the common desires of the lease holders of the field. The result is that the holders of the working interests determine what vacuum shall not be exceeded.

The plea for the introduction of sealed regulators came on te basis of the necessity of so fixing matters that an unscrupulous operator could not exceed the maximum vacuum in defiance of rules.

Keep Check on Neighbor

In this connection representatives of the oil companies made it plain they keep check on what takes place on neighboring leases. It further developed that this checking is done with the approval of all companies and that very few instances are uncovered where vacuum specifications are being exceeded. Furthermore it was brought out that intentional breeches are less numerous than purposeful ones. Even when specifications are violated, the matter is adjusted by conferences and agreements of the lease operators, rather than through recourse to the Corporation Commission.

As for the willful violator of vacuum specifications, the opinion of those at the hearing was that no device ever could be made to prevent him from violating vacuum specifications.

The discussion of checking neighboring properties developed the fact that vacuum of as high as 26 inches has been applied to a line well, while an offset well, without vacuum, has continued to hold even production for as long as six years. This was but one instance.

Other testimony was that excessive vacuum on one lease might stimulate oil output on the wells to the damage of adjoining properties. But the witnesses let it be known it would take a wide range of difference in vacuum to cause them any anxiety over well output.

Much of the hearing revolved around the time C. P. Buck, engineer and manufacturer, of Topeka, Kansas, was on the stand. His fund of knowledge proved equal to questioning of the practical men, who came to the hearing. For more than two hours he was on the stand. The questions and answers ran the gamut of the theory and application of vacuum, while part of it has to do with the effect of vacuum on oil sands and oil deposits. During this time the stenographer spent a hectic session, while he asked

Plant of the Amity Gasoline Company with Electric Power House in the background.

Electricity Solves Limited Gas Supply

Consistent vacuum credited with gaining high yield at Amity plant near Dewey

By Grady Triplett
Staff Representative

WHEN confronted with a residue gas supply, insufficient for operating the leases on which it drew, the Amity Gasoline Company converted its plant near Dewey, Oklahoma, into one of electric drive, added a power station and put motors in the field for pulling vacuum and operating pumping powers.

As now operated, electricity is generated by two engines, which use residue gas for fuel. The compressors in the gasoline plant are driven by electric motors. On the leases are poles and wires leading to the vacuum stations and pumping powers.

The arrangement is not one to be considered when residue gas is sufficient to drive the compressors and furnish sufficient power for the leases. But in the case of the Amity, it was a question of finding some other power or not operate, as the residue gas was too low in volume for both plant and field use.

Arrangement Easy

The Amity Company had this in its favor. It drew the bulk of its gas from leases owned by the Wiser Oil Company. The two have common ownership and management, so there was no difficulty in arranging to furnish electric power for pumping the wells. The plant, known as No. 4, draws gas from some other properties and to these the residue gas is returned.

When the plant was started in 1918, officials of the company had in mind electric power, as it was known that the residue gas would be scant. By June, 1919, the power plant had been completed, so motors replaced gas engines in the gasoline plant, as well as on the leases nearby.

The power plant is built of concrete blocks, with roof sloping to a point. Two Foos gas engines, each of 250 horse power, furnish power for the generators. These engines run in parallel, being connected direct to the two Westinghouse generators, driven at 200 revolutions per minute. The generators are 2400 volt, 60 cycle, three phase induction type, usually generating at around 2200 volts capacity.

The switchboard is so arranged that any circuit can be thrown out without interference to the other circuits. The board is equipped with automatic over load and low voltage release switches.

Outside the plant, the current as generated is "stepped up" to 6600 volts on the three lines going to the leases for power at the vacuum stations and the pumping powers. Then it is reduced to 440 volts at these points for driving the motors.

For the gasoline plant, however, the current goes direct from the power station at around 2300 volts, as the motors there are equipped to run at that voltage.

The gasoline plant has two 12-6-12 Ingersoll-Rand generators, two 14-10 Intersoll-Rand duplex vacuum pumps and one 14-10 single vacuum pump. The plant is the compression type.

The two compressors are driven by 75 horse power, 60 cycle, induction type, Westinghouse motors. Two 30-horse power motors of the same design drive the duplex vacuum pumps, while one 20-horse power motor drives the single pump. All equipment is belt driven.

A five-horse power motor is used for a line shaft, off of which the two water pumps and a small air compressor, to provide starting air, are driven. The water pumps are 5¾x6 Goulds manufacture.

Gas for Auxiliary

For auxiliary power in the gasoline plant, a Foos gas engine is provided. It can be used to take up the plant load, or part of it temporarily, when it is necessary to shut down any or all of the electrical equipment for repair.

On the leases, electric motors have

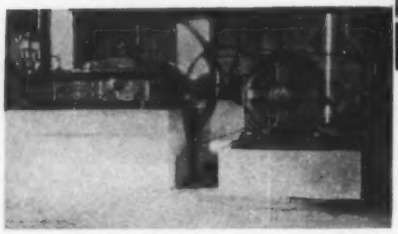
---

speakers to spell out the technical words they were using so profusely.

Members of the Corporation Commission evidenced interest in only one general phase of the hearing. They wanted to know if the adoption of vacuum regulators would accomplish any useful purpose in oil, gas or gasoline production. They had negative replies from representatives of the oil industry.

The case was taken under advisement for later decision.

Below is shown the arrangement of Westinghouse motors and Ingersoll-Rand Compressors. To the right is a motor driven power installation on the Wiser Oil Company's lease.



been installed where gas engines commonly are placed. In some instances on the Wiser leases the motors were placed in positions once taken by the gas engines. In other instances, the gas engines were left, while the motors were placed at some other point.

Motors in Concrete

In the gasoline plant, the power house, the vacuum stations and the pumping power houses, all motors are set on concrete blocks. Each is equipped with all possible safety devices, especially as to starting and control switches.

There are nine vacuum stations and 11 pumping powers on leases from which the plant draws gas. The powers are driven by 20 horse power, 440 volt Westinghouse motors, while 15 horse power motors drive the vacuum pumps.

One electrician attends to all the electrical equipment. While that is not his whole work, his first duty is to keep the electric equipment in proper condition. Even the oiling of motors is left to him. Two days of each week are given to inspecting the field equipment. He goes to every pumping power and vacuum station on the leases.

Let George Do It

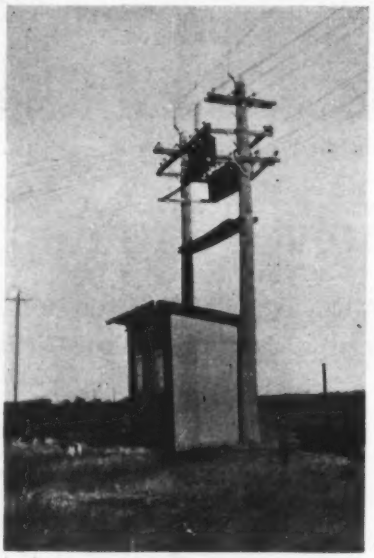
The pumpers are under instructions to make no attempt to repair an electric motor. If one fails to start or does not start properly, the pumper must call for the electrician. Otherwise the duties of the pumper are similar to those on a lease using gas engine or other power.

The electrician at the Amity plant has time, outside his work with the electrical equipment, to attend to loading gasoline and do some other mechanical work.

He looks after the lightning arrester equipment, placed a short distance from the power station.

Recovery in the Amity plant is double that of other plants in the same district. It is the opinion of A. M. Jones, builder of the plant and now its superintendent, that this is due chiefly to the consistent vacuum maintained because of the electrical equipment.

The mercury column at the plant the day the writer visited the plant, stood at 26 inches. And this was maintained with the plant pumps pulling against



Lightning arresting equipment near the power house.

the field pumps. The equipment pulled so steadily that the mercury column showed no variation. Charts from the recording gauge showed that this consistent vacuum was maintained throughout the day and that each day showed so little change that it was negligible.

High Vacuum—High Yield

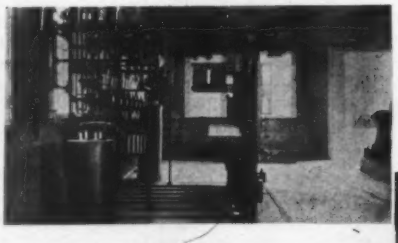
This one condition is given chief credit for the high yield at the Amity plant. This never goes below 8 gallons to the thousand cubic feet of gas, while yields of around 10 gallons are common.

Gas comes into the plant through a 10-inch field line from the Wiser properties. Scrubber tanks are equipped with the Nu-Way Vacuum Water Drip, a device invented an B. E. Downton, who is employed at the plant.

The plant has two batteries of storage tanks, one being covered and the other left open. Only raw natural gasoline is shipped from the plant.

In the plant office there is a small gas engine and generator for providing plant light, should it ever happen that the whole equipment of the power station were out of commission at one time.

Employes houses for the plant and for the oil property are near the gasoline plant, so the gas left after the electric generators are driven can be piped to the houses for home use.



Above is shown rear of switchboard; to right is an interior view of the power house showing Foos Gas Engines and Westinghouse generators.

Seek Change in Gasoline Specifications

(Continued from page 13)

an attempt was being made to lower the quality of gasoline. Today the situation is almost entirely reversed and the time seems to us to be very opportune for remedying the condition. It is possible that the Mid-Continent refining industry is affected to a greater degree than some of the other sections of the country, because probably a larger percentage of our gasoline is made in accordance with U. S. Motor specifications.

End Point Lower

"We are not questioning the wisdom of the A. S. T. M. committee or the Federal Specifications Board in their step of removing cotton from the thermometer bulb, although there is still some disagreement among the technologists as to the advantages gained by doing so. There is, we believe, no substantial disagreement, however, that removing the cotton raised the temperature indications, the gasoline made to conform with the new method was lower in end point than that made under the old and that there is a reduction in the percentage of gasoline obtainable to conform to the new method.

"We therefore ask that the Federal Specifications Board revise the distillation points in the specifications for U. S. Motor gasoline to four degrees higher than at present, over the entire range of the distillation, so as to equalize the quality with the former satisfactory conditions."

History and Efficiency of Cracking Methods

Science has reached high development since Young, Benton, and Dewar and Redwood worked our processes

By George A. Burrell
Consulting Engineer, Pittsburgh, Pa.

THE cracking process of today represents a great advance over processes proposed by Young (1867) Benton (1887) Dewar & Redwood (1891) and a score of others who interested themselves in such processes one-third to one-half a century ago. Their work was predicated on the fact that all organic substances are readily decomposed by heat; that ordinary distillation of oil without high temperatures produces some cracking; that the hydrocarbons in coal break down when heated (proposed by Murdock in 1792, to make gas); that oil had been cracked to make gas; and from investigations into the thermal decomposition of hydrocarbons; Dalton (1809), Berthelot (1866-67) and others.

The first cracking stills were small cylindrical shells in which the oil was heated under relatively low pressure to keep the vapors in the cracking zone under elevated temperatures. Burning oils and aromatic hydrocarbons (principally benzene) were the products sought. No incentive prevailed for an extensive development of the art; hence it remained for the period 1912 to 1925 to witness this development.

Big Step Forward

The cracking process of today represents a great step forward in its methods of avoiding carbon troubles, of refluxing the charging stock, of preheating the oil, of fractionating the distillate and in its apparatus design over the conceptions of oil cracking that prevailed prior to the period 1912-1925. It can also be said that given the same gasoline demand and present day information the early technologists would have gone as far as the technologists of today have gone.

It is sometimes considered that these early investigators practically closed the door on real patentability of worthwhile disclosures in cracking oils. But patentability covers among other things:

1. A new combination of steps.
2. A process comprising new ways of treating materials.
3. The assembly of old elements into a new combination, producing a new result.

With these elements of patentability before one, one can compare the processes of today with those of 25 or more years ago with credit to both groups, considering the times.

When it comes to patentability of one or more recent stills, as compared with other recent stills, there may be cause for dispute (a battle is on in the court now covering this matter) but certainly not when one compares 1925 processes with those of years ago. There has gone into this development, the best effort of hundreds of technologists and an amount of money probably ranging from 50 to 100 million dollars. Could the art have stood still?

Experimental

It is in the experimental side that the art is weak. The advance here as compared to the practical development of stills is small. But this is frequently the case. Many developments have proceeded to a huge financial success with the technology of the art trailing far in the rear. It is not something peculiar to the cracking industry. Analytical chemistry is regarded as the drudgery of chemical science, but if analytical methods were developed to a point where the product of cracking reactions could be accurately analyzed technologists would know a tremendous amount about those reactions. Cracked products may consist of a mixture of Paraffine, olefine, aromatic, diolefine and napthene hydrocarbons; of complex sulphur and nitrogen compounds, and other substances. Most of them are exceedingly difficult to isolate quantitatively. From the liquid products attempts are made to determine the unsaturated hydrocarbons by the sulfuric acid or by the iodine method, but the results are admittedly incorrect and only comparative.

The hydrocarbon gases can be quantitatively separated; for instance methane, ethane, propane, butane, ethylene, propylene and butylene, as well as hydrogen and carbon monoxide. These are gaseous products that survive cracking reactions in greater or less degree, and if a careful study were made of them by fractionally distilling them at low temperatures, a great deal could be learned about the changes which take place when petroleum is heated under different conditions. But the work is tedious and experimenters have not the time or the inclination frequently to do the necessary work.

The paraffin, napthene and aromatic hydrocarbons predominate in petroleum; the paraffines in all light distillates, in fact natural gas, the lightest distillate of petroleum, contains no other hydrocarbons. The napthene hydrocarbons predominate in all heavier distillates of petroleum particularly so in the Mid-Continent, Coastal and California Crude oils. In some of the latter large amounts of the aromatic hydrocarbons are found. We do not know the structure of the higher boiling napthenes. It is a known fact that light Pennsylvania lubricants are predominatingly napthenic in character. The wax is paraffinic but this is removed, so that calling a Pennsylvania base lubricant a paraffin base oil does not necessarily make it a good lubricant. In fact paraffin hydrocarbons lack viscosity. If one wants to grant the superiority of Pennsylvania lubricants, that superiority will have to be founded on something else besides paraffins in the oils.

Theoretical

In discussing our knowledge of the thermal decompositions of the hydrocarbons, it can be said that we know little about the chemical composition of the intial charging stock (distillate) that is decomposed. Further, we know little about the end products and about nature of the intermediate reactions. If the temperature is carried far enough carbon and hydrogen are the end products. The composition of the liquids produced is more or less of a closed book, except that it contains paraffins, olefins, aromatics, napthenes, diolefins, alcohols, sulfur and nitrogen compounds and other substances. Various hydrocarbons of these series have been isolated but never exhaustively enough to bring about anything more than speculation concerning the reaction tendencies. The gaseous products have been frequently examined, but seldom have the hydrocarbons been separated with exactness.

We know that complex hydrocarbons break down into simple ones; finally carbon and hydrogen if the temperature is carried far enough. The first tendency in breaking the paraffin molecule is its scission into a large olefine and a small paraffin. Haber and Engler showed this as long ago as 1896; at lower temperatures the olefine and paraffin are of more nearly equal size. In other words, if heated to high temperature too much gas is formed, as in cracking oil to make gas. This latter has long been known, of course. As soon as primary changes occur, secondary and tertiary reactions are set up involving new products; the nature of the vessel has an effect; pressure a profound effect; polymerization occurs; relatively small differences in

temperature produce striking changes, and catalysts, if introduced, modify the reactions.

Methane is the last to break down into carbon and hydrogen. Methane is in equilibrium with its decomposition products, carbon and hydrogen, to the extent of 0.20 per cent at 1200° C. As far as the nature of the other gaseous hydrocarbons that survive is concerned, the author can quote his own results. The products were carefully examined in a tedious round of fractionations at low temperatures in analyzing carburetted coal and water gas. The results follow:

Constituents	Per Cent
Carbon Dioxide	4.8
Oxygen	...
Carbon Monoxide	29.8
Hydrogen	32.0
Methane	13.1
Ethane	2.9
Propane	.3
Ethylene	9.8
Propylene	2.8
Butylene	1.7
Benzene*	1.5
Nitrogen	1.3
Total	100.0

* Vapor having an inappreciable vapor pressure at —78° C.

The higher gaseous olefines, it will be noted, are present in greater quantity than the corresponding paraffines. However, methane is the most resistive hydrocarbon, as usual.

The paraffins, olefines, aromatics and napthenes all have been decomposed at different pressures, temperature, with catalysts, in glass tubes, metal tubes and under a great variety of conditions. But it helps little to only specify the general character of the product. This has been the usual result.

The heavier the hydrocarbon and the more unsaturated it is the easier it breaks down. Thus heavy petroleum distillates from Mexican oils break down too easily. Too much carbon and gas are produced.

The aromatics to a noteworthy degree retain their aromatic structure when they decompose. Hence during the war benzol and toluol were made from aromatic petroleums, like those of California and Borneo. In cracking petroleum distillates to produce appreciable quantities of aromatic hydrocarbons, higher temperatures have to be employed than when gasoline only is wanted. Temperatures of the order of 1100-1200° F. are used.

Olefines are not present, except in negligible amount in crude oil. But they are exceedingly active intermediate products of cracking reactions.

Diolefins are hydrocarbons isomeric with acetylene hydrocarbons and are objectionable bodies found in cracked distillates, supposed by some to be responsible in part for the gummy deposit formed from unrefined cracked distillates.

The olefine and diolefine hydrocarbons are readily polymerized. This has been experimentally observed. T. T. Gray largely polymerizes the diolefins with heated Fuller's earth in commercial refinery apparatus he has installed.

Pressure keeps oil vapor in the still so it can be cracked. It also polymerizes unsaturated bodies, so that the cracked bodies in pressure still operations are not nearly as olefinic as in atmospheric pressure operations. The mass law comes into play in that an accumulation of cracked products slows up the decomposition. Equilibrium conditions are not attained because the reactions do not proceed to completion.

Liquid Phase Processes

The successful processes of today are liquid phase processes. Mechanical arrangements have not been perfected to the point where oil vapor can be as uniformly, economically and as satisfactorily heated as oil liquid. Further, in the liquid phase processes, the distillate quickly leaves the reactive zone; in vapor phase process it traverses a relatively long reaction zone before it emerges from the furnace, hence it undergoes too much cracking.

Vapor phase systems cannot handle heavy distillates successfully. The tubes choke up with carbon. Temperatures are always higher than in liquid phase systems. The difficulties are mechanical ones, hence a really successful vapor phase process waits on the proper still design. It is a fact, however, that there is no sharp line of demarcation between liquid and gaseous phase systems as cracking processes are used today. The best that can be said about the so-called liquid phase processes is that with the exception of the cross process, the liquid phase predominates. Some of the light products are not liquified. Pressures are not high enough.

Commercial Stills

The early Burton still (1913) was the first commercial still of consequence. In fact the Standard Oil Company of Indiana attained such a start on competitors that for years it dominated the field. Everybody is familiar with the early Burton still, and its successor, the Clark-Burton type. The former is now an obsolete type.

Science has justly recognized the achievements of Burton and his associates. They brought home to the industry the commercial feasibility of the art of cracking and showed the way in the application of principles long known, to the heating of oils under pressure in refinery stills. Only Wm. Burton and his associates know of the funds they expended in experimental work, of the endless experiments they performed, of the hazards the workers incurred and of their successes and disappointments. It was something new to heat 250 barrels of oil to 800° F. under a pressure of 75 pounds in a shell still; carbon deposition caused the most trouble.

For some time they maintained (and perhaps do yet) that condensing under pressure makes a difference in the character of the pressure distillate produced. However, it is generally recognized that the only difference is a small increase in yield at the run tank. The early Burton still was an ordinary cylindrical still heated under pressure. Many combinations of pressure and temperature were tried and different kinds of distillates cracked. Finally pressures of about 75 pounds and temperatures of about 800° F. were used. The cracking stock was limited to gas oil. Carbon collected on the bottoms in excessive amounts, hence false bottoms were inserted on which the carbon deposited. Millions of gallons of gasoline were produced, with this type of still. How much, only Burton's Company knows.

Clark-Burton Still

It was natural that E. M. Clark, working with Burton and supervising every step in the development work, should conceive of the use of a still like a water-tube boiler. Instead of burning out plates, tubes burned out and were more easily replaced. This was the Clark-Burton still. Finally Hopkins put on a dephlegmating tower. Fresh charging stock entered the top of the tower through an exchanger therein, met cracked vapors ascending and dropped to the bottom along with heavy ends of the cracked distillate and then entered the still.

J. W. Coast at the Cosden plant in Tulsa, Okla., built stills in 1917 much like the Burton stills except a mechanical arrangement continually scraped the carbon as it was formed to an end of the still away from the baking action of the fire.

W. F. Rittman and his associates in 1915 gave cracking the first real impetus, insofar as a host of independent refiners in this country were concerned, when the Bureau of Mines announced his process. His was a vapor phase process. But his tubes were too big, and velocities too low. Carbon troubles were encountered. However, Rittman's theoretical and practical work were real milestones in cracking progress in this country. The cracking art was largely locked within the Standard Oil Company. The other companies wanted to share in it and Rittman's process seemed to be the way. Though their hopes did not fully materialize, they and their technologic staffs learned a lot about cracking from the Rittman experiments and publications.

Vapor Phase Process

About the same time, in fact a little before (1914), W. A. Hall in England started working with a vapor phase

JENKINS CRACKING PROCESS

Standard Unit

Produces Quality Gasoline

Export specification without rerunning

Unusual Low Cost

No loss in product or time from coke formation

Flexibility of Unit

Market condition alone determines product

Manufactured and Sold only by

GRAVER Corporation *Founded 1857*

EAST CHICAGO, INDIANA

Steel Tanks and General Steel Plate Construction

Water Softening and Purifying Equipment

Atlas Building	West Building	Steger Building	Grand Central Term.
TULSA	HOUSTON	CHICAGO	NEW YORK

Any office can give you complete information

MATHIESON Chemicals

Mathieson Hypochlorite Process and Mathieson Chemicals

THE Mathieson Hypochlorite Process is steadily gaining favor among oil refiners and is now in successful operation in a number of plants throughout the United States.

The refining of gasoline and kerosene with Hypochlorite involves no expensive changes or additions to existing equipment and shows many distinct advantages over the long-established acid-alkali treatment. The Hypochlorite of Lime solution, which is made up at the refinery from liquid chlorine, presents no difficulties in its preparation or in its final disposal after use.

Our extensive facilities for the production and transportation of Liquid Chlorine enable us to give the best of service to all refiners using our process. We also produce and market direct to the petroleum industry the following standard chemicals: Caustic Soda, in solid form and in tank cars of liquid solution of any desired strength up to 50% Sodium Hydroxide; Bicarbonate of Soda, for all foam type fire extinguishers; Bleaching Powder, sometimes used in making up hypochlorite solutions; Soda Ash, Anhydrous Ammonia and Aqua Ammonia. Quotations and shipping points gladly given on request.

The MATHIESON ALKALI WORKS Inc.
25 WEST 43rd STREET NEW YORK CITY

PHILADELPHIA
PROVIDENCE

CHICAGO
CHARLOTTE

EAGLE THISTLE PRODUCTS

Deal Direct with the Manufacturer

Bicarbonate of Soda Sesquicarbonate of Soda
Liquid Chlorine-Caustic Soda Bleaching Powder-Soda Ash

Tell them where you saw the ad

process. He elected to use long small diameter tubes and high velocities. Hall made a point of very carefully controlling temperatures and maintaining high velocities. He could more uniformly heat the oil using small tubes.

Both the Rittman and Hall processes were put to use during the war to make benzol and toluol from petroleum for explosives.

Greenstreet Process

C. J. Greenstreet's efforts in the vapor phase treatment of distillates have been much overlooked. He was one of the real pioneers as far as a commercial still is concerned. The writer examined a commercial still he built in St. Louis in 1913. He started work on it in 1908. Greenstreet used steam to help sweep the carbon out of his tubes. Steam, like hydrogen, is composed of small molecules compared to the oil molecules. These vibrate fast and rapidly dissipate heat from the tube walls to the interior of the tubes. Carbon does not bake on the tube walls. Steam takes up space, decreases partial processes and slows down the output of a furnace. It is expensive to use. But until other and better methods of avoiding carbon troubles were developed the steam method possessed advantages.

First Cross Patents

The first Cross patents were taken out in 1916 and the first practical installation completed at the Indiana Refining Co., Laurenceville, Ind., in 1919. Pressures of 600 lbs., and temperatures of 900 to 915° F. are used. This process has survived and is now one of the practical stills of the industry. An outstanding feature of the Cross process is a separate coke and reaction chamber made of a steel forging 30 inches in diameter and 40 feet long. The oil is preheated, passed rapidly through the cracking tubes and then forced into the reaction chamber. Here the cracking reactions are completed and the coke is deposited. This general method of attack is that adopted by other highly successful stills of the present time. To the Cross Brothers go a lot of credit for their early adoption of this method. They long elected to make what they called synthetic crude oil; merely cracked distillate. This was cooled and then fractionated. Now an efficient fractionating column takes the distillate as it comes from the reaction chamber and fractionates it.

Aluminum Chloride Method

Hydrogenation was never successful. Many attempts followed the early work of Satatier in which nickel was used as a catalyzer. But the nickel became covered with coke and inactive. Bergius' recent work in Germany shows that hydrogenation at high pressure (100 atoms) has possibilities. Bergius' first patent was taken out in 1914. Lead baths have been extensively tried and given up, at least for the present.

Prior to the war (1913 and 1914) G. W. Gray of the Texas Company and A. M. McAfee of the Gulf Company, started work on the aluminum chloride method (Friedel & Craft's reaction), of cracking distillates at atmospheric pressure. McAfee has continued his work practically up to the present time. This method cannot compete with pressure cracking stills of the present day. It costs too much to recover the aluminum chloride. The latter mixes with the coke and tar. Otherwise the method is an ideal one. No pressure is used and a much better cracked distillate is produced from the standpoint of odor, color and ease of refining. The distillate is more paraffinic than pressure distillates. It is marketable with little or no treatment.

Dubbs Patent

Following the war the Universal Oil Products Company brought the Dubbs patent (1909) to the attention of the industry and has sued the Standard Oil Company of Indiana for infringement of the process. The Standard Oil Company retaliated by sueing the Universal Oil Products Co. To further complicate the situation, the Standard Oil Co. of New Jersey has sued the Universal Oil Products Co. for infringing their patents.

The Texas Company, the Standard Oil Co. of Indiana, the Standard Oil Co. of New Jersey and the Gasoline Products Co. (Cross process) have pooled their patents and formed the so-called patent club, which is under attack by the U. S. Government for violating the Sherman anti-trust laws. The members of the patent club use each other's developments.

The Dubbs process, now promoted by the Universal Oil Products Co., is a development from the early Dubbs dehydrating process. the present process is one of the successful cracking ones of the present day. One hundred and ten units are in operation. Much credit for this development goes to Gustav Egloff and his associate, Jacques Morrell, who later joined the staff. Egloff was long associated with Rittman; in fact, was with the latter at Columbia University in 1914 where he performed his early oil-gas cracking experiments. H. J. Halle has very successfully guided the business policies of the company. In the author's opinion, the Dubbs, Cross, the Tank and Tube, the Holmes-Manley and the Auld-Dustan-Herring processes represent the best in the cracking art today.

In the Dubbs process the oil is first preheated then rapidly passed through the cracking tubes where it is heated to the cracking temperature and then discharged into the reaction chamber where the cracking reactions complete themselves, and here the carbon is deposited. Distillate passes to a dephlegmator where fresh stock cools it, refluxing the heavier ends for recracking and allowing the light distillate to pass to the condenser. The capacity of the system is almost wholly limited by the size of the coke chamber. One or two are provided. Each will hold about 30 tons of coke.

The general principle, it will be noted, is much like the Cross system. However, the Cross system is a real liquid phase system. His pressures are high enough to keep light distillates in the liquid condition. But these high pressures impose a limitation on the apparatus. The capacity of his coke chamber is limited thereby, and his process cannot run long on heavy distillates.

The Dubbs and similar processes are better suited for running heavy distillates. Particularly the Dubbs process. It cracks fuel oil better than any other process.

The recent use of a hot oil pump to the Dubbs process for recycling refluxed material from the dephlegmator has greatly increased the throughput of this unit.

Cross has added a still to take light cuts off heavy oils so they can be cracked. But this is an ordinary tube furnace, not a cracking still.

Tank and Tube Process

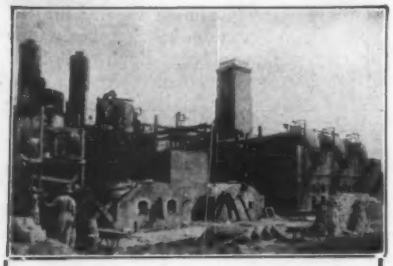
Much like the Dubbs process is the Tank and Tube process of the Standard Oil Co. of New Jersey (Ellis patent). In both of these processes the oil is preheated, charged through the dephlegmating towers (if wanted) then switfly passed through the cracking zone and the reaction allowed to complete itself in a cracking chamber where the carbon is collected. The Standard Oil Co. of New Jersey for a long time used the Burton-Clark processes and paid a royalty for same. They then purchased the Ellis patent and built their own apparatus. In the use of the Tank and Tube process the pressure is relieved on the refluxed material and it is tanked before going again to the heating coils. Apparently this is done so as not to infringe on the Dubbs patent covering the refluxing of oil from the dephlegmator.

Vapor phase processes passed completely out of the picture for a while; then De Flores of the New England Oil Refining Co. built one (1922) based on his early experiences with Hall. De Flores was closely associated with Hall for a long time. His company happened to have a large amount of light distillate available and a vapor phase system, because of its cheapness, was installed.

During the war the Gulf Refining Co. successfully operated a vapor phase process installed by C. M. Alexander. But during the war there was sufficient spread between distillate and gasoline to make it successful. The Gulf Company has successively tried the McAfee, Emerson and Alexander processes. Now they have installed a liquid phase Tube and Tank process.

Emerson and Jenkins

The Emerson process was one of the



An Authority on Oil Still Construction Says:—

"High temperature cement has to a great extent taken the place of fire clay in recent years, especially where extremely high temperatures are required. This cement is applied between the brick in the form of a paste and a thin layer is spread over the face of the brick. After the furnace has been fired, this cement unites the brick into a solid wall, and forms a glazed surface over the brick, thereby protecting the brick from disintegrating under the extreme heat."

Many Oil Producing and Refining Companies are using

HYTEMPITE

(Reg. U. S. Pat. Off.)

For

1. **Laying Fire Brick.**
2. **Patching Furnaces.**
3. **Making one-piece Baffles.**
4. **Making Special Shapes and Tile.**

because HYTEMPITE bonds at normal room temperatures and the bond extends through the entire thickness of wall or arch.

400 pounds will lay 1000 brick

HYTEMPITE is warehoused at or near all oil fields and industrial centers for immediate delivery.

Instruction booklet HO-109 on request.

QUIGLEY

Furnace Specialties Co.,

INCORPORATED

26 Cortlandt St. New York

many novel processes devised. It was probably simply a fairly successful liquid phase process, although the inventor claimed molecular disruption by violent impact of the molecules against each other.

The Jenkins and Isom stills can be included in list of successful processes. They are built like a water tube boiler with a circulating arrangement (paddle) to keep the oil moving fast from the drum to the tubes, thus speeding up through-put, preventing overheating, and causing the carbon to largely deposit in the drum instead of baking on the tubes. They are essentially the Clark-Burton stills except with circulating arrangements. But the latter are very effective.

The Ramage process appeared since the war. This was operated under atmospheric pressure and the oil vapors passed over iron oxide. A catalytic effect was obtained. But it did not survive. An installation was made at the plant of the Barnsdall Refining Co., Bigheart, Okla.

Holmes-Manley Stills

The Holmes-Manley stills of the Texas Company consist of a tube furnace with four vertical reaction chambers. In action they are much like the Dubbs, Cross and Tank and Tube stills. The reaction chambers are fire heated to some extent.

The Fleming still is a cylindrical still on end. The sides are heated and carbon scraped from the sides at the finish of a run. Most of the carbon collects in the bottom and is easily removed. They are not now being pushed. The Kellogg Co., N. Y., formerly sponsoring them, have taken up the installation of the Cross still. These shell stills are too hazardous.

In England the Hall vapor phase still for years occupied the limelight. Now the Anglo-Persian Oil Co. have installed the Auld-Dunstan-Herring still. This is much like the Cross, Dubbs, Holmes-Manley and Tank and Tube stills in its method of operating.

Auld-Dunstan and Herring have summed up the requirements of a present day cracking still. They say:

1. The pressure should be sufficiently high substantially to maintain the oil passing through the plant in the liquid condition for all but the lightest products. This can be maintained by using pressures of the order of 25 to 30 atmospheres.

2. The yield of light products should be deliberately restricted because (a) the retention of the heavier oil helps to hold up the carbon formed and move it forward to a point most suitable for its deposition. (b) The greater the extent of decomposition the poorer the quality of gasoline and the greater the amount of gas and carbon found.

3. There is an appreciable lag between the moment of attaining the cracking temperature and the formation of the products and (c) the temperature must be maintained for a considerable length of time if the maximum cracking is to take place corresponding to that temperature.

4. Carbon must be induced to deposit in places suitable for its removal

These are principles which have been developed and which now find application in the most successful cracking processes.

Summary

The important steps in the development of the cracking process may be briefly summed up as follows:

Early work on the decomposition of organic substances; on oil and coal to make gas and the cracking of hydrocarbons on a laboratory scale (years 1800 to 1867).

Work of Young, Benton, Dewar Redwood and many others on cracking oil to produce light distillates, principally burning oil and aromatic hydrocarbons (1867-1891). Shell stills of sample design and ineffective today.

Modern Cracking Developments, 1908 to 1925

The most noteworthy work of this early period was that of Burton and his associates working with shell stills in the so-called liquid phase, followed by their use of the water-tube boiler type of cracking still in which the heating was done in underslung tubes and the oil circulated between those tubes and an overhead drum, where most of the carbon deposited as the velocity of the oil slackened.

Simultaneously Greenstreet worked in the vapor phase using steam along with the oil in a tube furnace. Others followed him using steam.

Next came Hall and Rittman with vapor phase systems; Hall the more successful of the two, but Rittman exercising a profound influence in stimulating cracking developments.

In the meantime Gray and McAfee had proposed the aluminum chloride process with McAfee and associates carrying the development much the farthest. This process is practically inoperative commercially.

Cross then proceeded to develop his high pressure liquid phase (actual) still keeping the cracking and reaction zones (carbon chamber) separate.

The Universal Oil Products Co. brought forth the Dubbs process and developed it to a modern cracking system, in which the heating and reaction zones are separate. But lower pressures aer carried than in the Cross system (150 to 350 lbs.) so that the reaction chamber can be built large enough to hold a large amount of carbon. Hence, heavy stocks can be cracked. The Cross system is limited to lighter stocks.

The vapor phase processes gave way to liquid phase ones. Steam is not used, or hydrogen, or catalytic substances. Every effort is concentrated on simplicity, on throughput and on the cracking of heavier oils.

The Tank and Tube, Auld-Dunstan-Herring and Holmes-Manley processes also represent modern cracking developments.

Corrosion Makes Big Inroad on Profits

Ever present plant problem cost refiners large sum annually. Some sidelights on cause and prevention

From a paper read before the Western Petroleum Refiners Association at Kansas City

By F. W. L. Tydeman

Superintendent Roxana Petroleum Corporation

STEPPING over the general theories, and also the matter of importance, which any one can estimate according to his inclination by multiplying the total barrels refined by such figure as he believes expresses the average share of corrosion troubles in total maintenance and other costs, we can consider the problem technically from the point of view that in general there are three things necessary wherever corrosion occurs.

1st—There is a corrosive substance;

2nd—A material to be corroded;

3rd—A set of conditions which enables the first to act upon the second.

In considering remedies we have to pay due attention to all three. That is, we can try to eliminate the corrosive substance, or use a material that is not attacked by it, or modify conditions so that the attack will not take place or will be greatly decreased.

Let us take as a first instance corrosion in the **topping distillation.** Here we find two major problems:

1st—Corrosion of the heating surface;

2nd—Corrosion of the condensing and cooling surfaces.

Of the **heating surfaces** we can have both external and internal corrosion and so far the former seems to cause most of the trouble. The main corrosive agent seems to be oxygen, acting upon the metal of the still by direct chemical action accelerated by high temperatures.

Analyzing the problems as outlined above we find that we can do very little towards excluding the corrosive agent. It is not possible in practice to fire without using excess air, and if we use only 10 per cent of the latter we still have some .3 pound oxygen per pound of fuel oil. This amount of oxygen can combine with about .7 pound of iron. It akes very little figuring to estimate that even under these most advantageous conditions enough excess oxygen will be used in an ordinary pipe still to combine with all of the iron exposed to the flue gas in about two days. It does not seem practicable therefore to attack the problem from this point of view.

Iron and Steel Cheap

As to the material of the still: In spite of easy oxidation, iron or steel continues to be used on account of cost. We have used special wrought iron pipe in pipe stills, but found no improvement over standard line pipe. The next attempt was to cover the steel with some more resistant material. This applies especially to pipe stills, and refractory tile, cast iron rings and others have been used with some measure of success. As always the question of cost, including fuel efficiency has to be considered. Calorizing, by which the surface is covered with aluminum oxide, has come into prominence in the last few years, but two trials which we have made did not result satisfactorily enough to induce us to adopt calorized pipe. I understand that others have been more successful and that is a point which I hope the discussion will bring further light upon.

Altering Conditions

Then the matter of altering conditions. The main point seems to be to lower the surface temperature of the metal. Of the factors involved I may mention first the formation of deposits on the internal surface, decreasing heat transference and thereby raising the external temperature of the metal. The natural remedy is to have the crude as clean as possible. Where it will in most cases contain some salt dissolved in water we can decrease deposits by maintaining high speeds relative to the inner surface. In shell stills it is common practice to use steam which also has other advantages. In pipe stills we can increase speed by decreasing the diameter of the pipe and we can also use steam. The use of cores in pipes appears impracticable. In pipe stills however, we have another aid in using counter-current flow. If the water is evaporated gradually in the cooler pipes, there is apparently much less deposit of its dissolved salts than in case it is evaporated suddenly in the hotter pipes. Also in case it is possible to evaporate the water in heat exchangers before the crude enters the still there is a greater tendency for the salt to remain suspended in the oil. Finally, if we have a salt deposit it can be effectively removed by periodical washing with hot water. At Wood River we have practiced this for the last six years to good advantage. Incidentally, with a Mid-Continent crude containing from .03 to .5 grams salt per liter, our newer pipe stills using counter-current flow are washed about every 40 to 60 days, whereas the older ones, not having counter-current flow, are washed every 10 to 15 days. The washing requires a 24-hour intermission from stream to stream, and the length of the intervening periods is governed by the amount of deposit found after previous periods and by the salt content of the crude oil as determined in the Laboratory.[1] The amount of deposit is calculated as NaCL by titrating the chlorin content in a sample of the wash water. The amount of deposit varies of course;—in our new units this is generally from a trace up to 50 pounds for one pipe heater. In the old units amounts upwards of 100 pounds were not unusual, although we tried to keep them lower Practically all of this deposit is thus removed without taking off the return bends.

Lower furnace temperatures can be maintained by using more excess aid which, however, is wasteful from a fuel economy standpoint and paradoxical as regards the quantity of corrosive agent supplied, although, I have explained above, this last point does not seem to make any difference. A better policy is to have the furnace construced with a large combustion volume, using plenty of heating surface to quickly take up the radiant heat, preventing concentration of the latter upon small sections of surface.

Next we have the possibility of internal corrosion of the heating surface, but here we have had practically no trouble, and it will be interesting to hear in the discussion whether others have had a different experience.

Second Problem

The second main corrosion problem in topping distillation is that of the **condensing and cooling surfaces.** Here again we may consider separately the external and internal surfaces, considering as external surface that exposed to the cooling medium, and the internal surface that exposed to the product to be condensed or cooled.

Where the corrosion problems are due to the cooling water used, they are not peculiar to the Petroleum Industry, and will not be considered further at this time. Where oil is used as a cooling medium, little trouble seems to be encountered unless the temperature is high enough to cause, in the case of crude oils, the decomposition of magnesium chloride with the formation of hydrochloric acid, in which case the effect is similar to that encountered at the internal surface from the same cause.

The main corrosive agents acting up-

[1]Determination of Chlorides in Petroleum, by R. R. Matthews, Journal of Industrial & Engineering Chemistry, Vol. 13, No. 4, page 325.

Bra

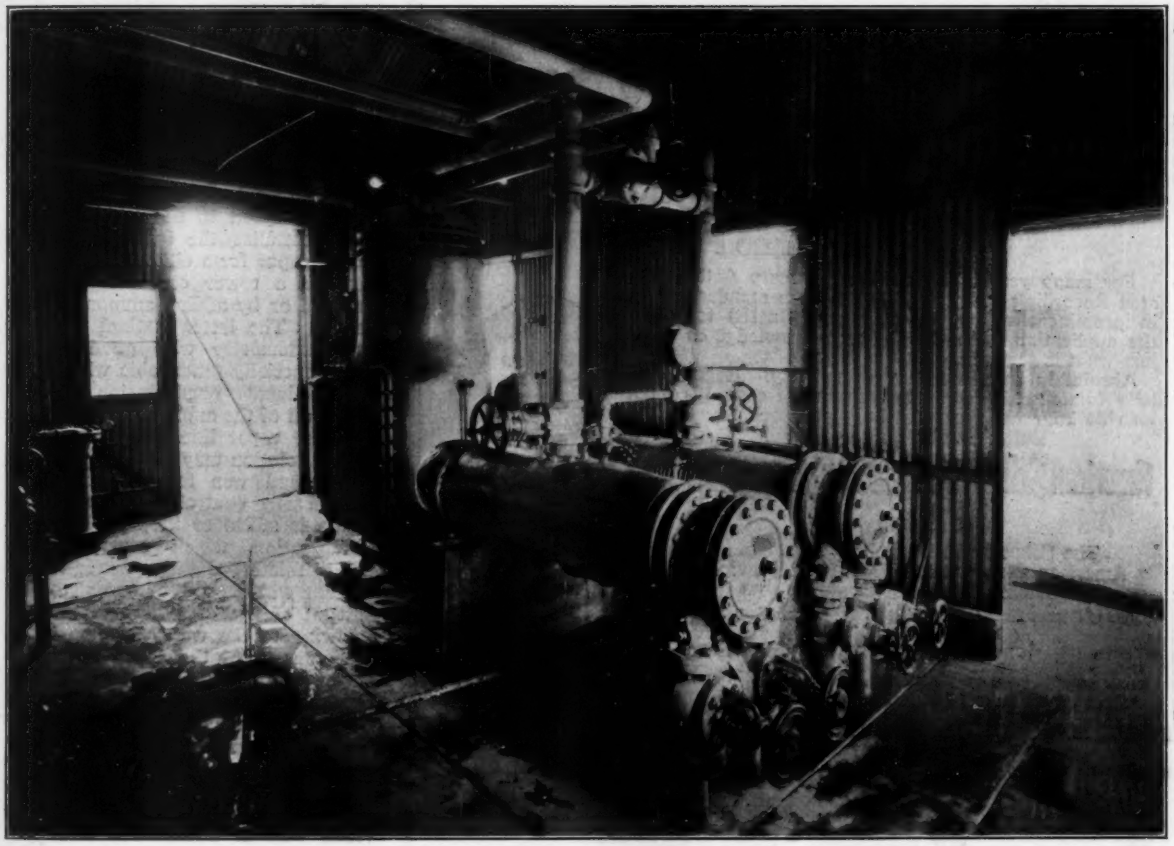
EVAPORATORS

BRAUN evaporators and distillers in two Midcontinent BRAUN equipp absorpt for boilers, compressor jackets, and heat exchangers. The use of this apparatus

C. F. Brau
Manufacturing Mechan
Factory & Executive Offic
Midcontinent Distric Offi

aun

RS & DISTILLERS



quippe absorption plants. *This apparatus is used to manufacture distilled water*
this apparatus minimizes corrosion and scaling in water lines and machinery

raun & Co.
Mechanical Engineers
tive Offices - Alhambra, Cal.
stric Office - Tulsa, Okla.

Accurate Measuring of Temperatures

WHAT is more important in the refining of petroleum than temperature? The precise maintenance of definite temperature schedules directly governs the efficiency of your processes, in turn, gauging the quality and quantity of your output. It is of vital importance, therefore, to select Temperature Measuring and Recording Instruments known to be and proved to be suited to the severities of Refinery service.

Reform Mercury Dial Thermometer

Is a mercury actuated, dial-face Thermometer widely used in Refineries. Combines essential accuracy with reading convenience. Furnished with 6" or 12" dial graduated for ranges up to 1000°F.

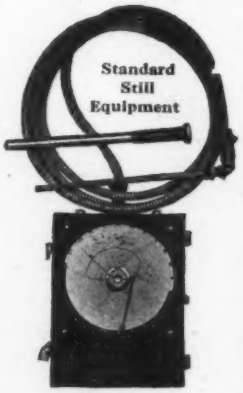
Bulletin G-16 on request.

Columbia Recording Thermometer
With the Time Punch

For many years the Columbia Mercury Actuated Recording Thermometer has been standard in prominent refineries. It is constructed for the application, with the aid of a knowledge of just what is required.

Absolutely guaranteed in every way. Regularly furnished in heavy moisture-proof case, 12-inch 24 hour chart, special bulb and socket.

Bulletin H-16 on request.



American Schaeffer & Budenberg Corporation

Succeeding

The Schaeffer & Budenberg Mfg. Co.
American Steam Gauge & Valve Mfg. Co.
Hohmann-Nelson Company

Makers of Pressure Gauges, Thermometers, Temperature Controls, etc.

BROOKLYN, N. Y.

*Boston, Buffalo, *Chicago, Cleveland, Detroit, *Los Angeles, Philadelphia, *Pittsburgh, Tulsa, Salt Lake City, *Seattle

*Stock carried at these branches.

Wilson-Snyder Hot Oil Pumps

NO LEAKS EASILY CLEANED

100% SAFE

WILSON-SNYDER

PITTSBURGH, PA. **U. S. A.**

on the internal surfaces are hydrochloric acid and sulphur compounds. There are probably others about which we know very little.

Most crude oils containing salt contain certain amounts of magnesium chloride. When the latter is heated to above 106 degrees C. in the presence of water it tends to decompose with the formation of hydrochloric acid and insoluble magnesium oxy-chloride according to the following equation:

2 Mfg Cl_2 plus H_2O—Mg_2 O Cl_2 plus 2 H CL.[3]

The hydrochloric acid apparently does very little damage as long as it is in the form of a gas, even when water vapor is present. But as soon as water in the liquid form is present, it dissolves the acid, forming a corrosive solution, and the effect is no doubt well known to all of you.[3] [5]

On general lines we may again attack the problems from three different angles. 1st—We can attempt to eliminate the corrosive substance (a) by using a clean crude from which the salt water has been settled out as much as possible. (b) We can neutralize the acid. For this purpose caustic soda or sodium carbonate or bi-carbonate has been added to the crude, but this of course tends to increase the formation of deposit in the still. We can also neutralize the hydrochloric acid in the vapor form either by passing it through a tower containing alkaline material or by adding ammonia to the vapors. The latter method has been used extensively with good results.[4] It is especially practicable when using a fractional condensation system, where all of the ammonia can be added into the vapor line. Either ammonia gas or solution may be used. The latter method was found cheaper and more easily controlled. Enough ammonia is added to keep the water of condensation, which separates from the distillates, slightly alkaline. The amount will depend, of course, on the amount of hydrochloric acid formed.

Owing to the wide variation in the salt content of the crude it has not been possible to make any accurate checks on the resultant saving, although the method has been in use for about six years with many million barrels of crude. Tests were made operating with and without ammonia and in one instance operation on Healdton crude without ammonia a steel condenser was corroded sufficiently after

[2]Chemical and Metallurgical Engineering, Vol. 31, No. 2, page 68—special corrosion number.

[3]Brine corrosion of Petroleum Equipment by R. R. Matthews and P. A. Crosby, Chemical and Metallurgical Engineering, Vol 22, No. 11.

[4]Corrosion Prevention in Petroleum Refining Vapor Systems, by R. R. Matthews and P. A Crosby, Chemical and Metallurgical Engineering, Vol. 23, No. 23.

[5]Corrosion of Petroleum Refinery Equipment by R. R. Matthews and P. A. Crosby, Chemical and Metallurgical Engineering, Vol. 25, No. 24

(Continued on page 36)

A close-up view of a pumping rotor

NORTHERN ROTARY PUMPS

"MORE GALLONS PER HORSE POWER"

Sturdy!

THIS is the NORTHERN rotor. Note its rugged, sturdy design, and the big shaft. Only the very best materials are used, selected according to the service for which the pump is made.

Each pair of rotors is fitted by hand to absolute contact at all points without binding. The packing strips in the end of the rotor teeth are also hand-fitted. This perfect workmanship plays its part in producing the unusual efficiency which NORTHERN Rotary Pumps develop.

The unique, sturdy design of the NORTHERN rotor is the first big secret of NORTHERN pep on the job. There are several other important features which you should know.

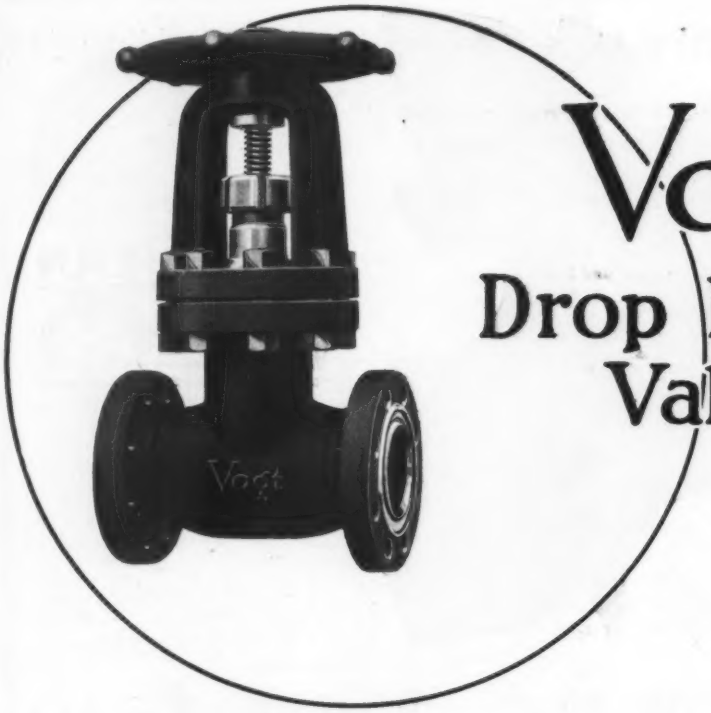
Write for catalog and full information.

NORTHERN PUMP CO.

DIVISION OF
NORTHERN FIRE APPARATUS CO.
MINNEAPOLIS MINNESOTA, U.S.A.
940 18th Ave., N. E.,

NORTHERN ROTARY PUMPS

Tell them where you saw the ad



Vogt
Drop Forged Steel Valves & Fittings

and their service to the Oil Industry

OIL is rated third among the industries of the country—being exceeded only by agriculture and the railroads. The investment in the oil industry today approximates fourteen billion dollars.

Thirteen years ago, the first Vogt Drop Forged Steel Valves and Fittings were made—one type of valve and a few fittings. Their growth and development have been less sensational than that of the oil industry, but steady and at an increasing rate. This is proof that their ability to stand up under difficult high pressure and high temperature conditions has been a genuine service to the oil industry.

At the last International Petroleum Exposition, 231 different Vogt Drop Forged Steel Valves and Fittings were displayed. Included were outside screw and yoke, bolted bonnet globe, angle and gate valves for pressures to 900 pounds at 1100° F. There were also many special drop forged steel valves and fittings developed by Vogt Engineers for refinery processes.

Future service of a more comprehensive nature is now being definitely prepared for. Research work in laboratory and field is constantly in progress to improve Vogt Drop Forged Steel Valves and Fittings and to anticipate the requirements of the Industry. The Vogt Organization will gladly and freely serve the oil industry in the solution of its valve and fitting problems.

HENRY VOGT MACHINE CO.

Incorporated

LOUISVILLE, KENTUCKY

NEW YORK · CHICAGO · PHILADELPHIA · DALLAS

Manufacturers of Drop Forged Steel Valves and Fittings, Oil Refinery Equipment, Water Tube and Return Tubular Boilers, Ice Making and Refrigerating Machinery

Tell them where you saw the ad

Review, Comparison of Fractionating Towers

Flexibility of Bubble Tower is such that any desired product can be secure with only one run

From paper read before the Western Petroleum Refiners Association at Kansas City

By W. A. Peters, Jr.
E. B. Badger and Sons Company

THE art of distillation is on old one. We find pictures and descriptions of simple stills and condensers in Agricola's de Re Metalliia published about 1500. Apparently, stills for purifying sulphur and mercury had been in use for a long time even then. About 1800 apparatus for the separation of liquid mixtures, which was more effective than the simple still, began to come into use. We find the Coffey beer still with its large dephlegmator coil which served at the same time as a preheater for the beer. In the Pistorius still which consisted of three still bodies through which the liquid ran in series while the vapor from the first was bubbled through liquid in the second and vapor from the second through liquid in the third we see the beginning of the idea of the bubble tower. Pistorius also had an arrangement of baffled partial condensers or dephlegmators, which suggests the bubble tower. About the same time, that is the early part of the nineteenth century, Ilges in Germany developed a tower packed with round balls and Cellier developed the idea of baffles to the limit.

French Bubble Tower

From these early towers the efficient French bubble type of plate was developed, starting with the spirally baffled plate of Egrot and the large single caps of some of the early makers and finally working up to the Barbet type in use in most alcohol refineries at present.

In many of these examples of distillation equipment several methods of obtaining the separation were employed, which has led to much confusion as to the relative values of the different methods available. We have, in general, three methods, namely, simple distillation, partial condensation and counter current scrubbing. We know that simple distillation is not a very effective means of separation and partial condensation is little better. The counter current scrubber is really the only effective means.

In all the towers mentioned the principle of operation is the same. They are simply a means for bringing into intimate counter-current contact a stream of liquid and a stream of vapor. We can imagine this being done in many ways, such as the following:

1. A spray of liquid falling through a current of vapor rising from a still.
2. A multitubular condenser with vertical tubes down the condensate runs. The vapor enters at the base and passes up the tubes.
3. No. 2, with obstructions in the tubes. (The French have hung chains in them).
4. Packed towers.
5. Multiple stage sprays such as a bank of Ceco's or Blair Campbell and McLean scrubbers.
6. Plate columns.
   (a) Bubbler plates.
   (b) Sieve plates.

Of these six methods, all but 4 and 6 can be eliminated as ineffective or impractical. No. 4, the packed column, looks like the ideal arrangement. In a tower you want intimate contact. Of course, the best way to get intimate contact is to provide a lot of surface for the liquid to spread itself on, then make it spread, and then pass the vapor over it counter current.

It was found, as might be expected, that the smaller the size of the packing pieces the more efficient is the tower. There is a practical limit, however, to decreasing the size of the filling pieces and this is reached at diameters of about 7/8-inch. Packed columns with glass rings 3/8-inch to 1/2-inch diameter were used with good results as long as the diameter of the column was small, but for columns even 20 inches in diameter much trouble was experienced with the distribution of reflux at the top and of vapor at the bottom. The efficiency of a column 22 inches in diameter was so low, due probably to poor distribution, that it had to be taken out and replaced by a plate column and no columns of larger diameter were tried.

Sieve Plate Column

The sieve plate column is ideal for some purposes, but it has to be built exactly right and run at a definite rate. As its name implies, it is made up of perforated plates. The velocity of the vapor passing through the perforations keeps the liquid from running through them and makes it pass across the plate and through the overflow pipes. Unless this velocity is sufficient, the plate leaks or dumps its load. This is a big advantage in many cases. Most still operators like to nurse a still along and run it as slowly as possible. If the still has a sieve plate column on it, it must be run to capacity to get any results at all. But this characteristic of sieve plates bars their use in cases where the desired capacity is not always the same. Another limitation of sieve plate columns is corrosion of the perforations. It takes very little corrosion on a small hole to double its area, and as the area is increased, the capacity must be increased. On these two grounds the sieve plate column is practically barred from the petroleum field.

Bubble Plant Tower

The bubble plate tower is the only all around fractionating device available. Its efficiency is the same for all capacities below the maximum and is unaffected by corrosion up to the point where the tower starts to leak. Where the efficiency can be accurately measured it is many times that of the best dephlegmator or partial condenser.

We have stated that the counter current scrubber or fractionating tower was the most efficient device known for separating mixtures of volatile liquids. But even the simple still gives some separation and it does not, therefore, follow directly that the fractionating tower should be used in petroleum refining. It would certainly not be worth while to separate materials that are to be sold mixed, especially when any separation by distillation even in the most efficient device imaginable requires a certain amount of heat. You can't have a counter current scrubber without the scrubbing liquid or reflux any more than you can get any good out of a dephlegmator if you lag it all up and don't condense anything in it.

The first question then is what products are demanded from the petroleum refinery and the second is what is the simplest apparatus that will give those products. To simplify the discussion, we will only take up one product, gasoline and will assume New Navy Specifications for this gasoline. Moreover, we are only interested now in the distillation range and not in the chemical characteristics.

You are all familiar with the curve

desired. End point 437° F, 90 per cent point 392, etc., measured, by the way, with a total immersion thermometer immersed 3 inches so all temperatures are off from 1 to 7° F.

To determine the composition of most fractions, an efficient laboratory fractionating apparatus which gave distillation curves within 1 per cent or better of the true distillation curve was used. It was found that the Engler curve crosses the true curve at abouf the 80 per cent point for most distillates and differs very little from the true curve above this point. The Engler was therefore used for determining the upper end and the more efficient apparatus for determining the lower end for all samples.

Considering first the product of simple distillation, we find that when a crude petroleum is distilled in any still from the sides of which there is a negligible heat loss we get a product showing a very steep rise at the upper end of the Engler curve. To get a 437° F. end point we must cust at about 320° F. and the difference between the 90 per cent point and the end point will be about 100° F. If a single continuous still or flash vaporization is used, the 90 per cent point may be still further from the end point. These fractions are lacking in about 45 per cent of material which was in the crude and which boils under 437° F. and most of this heavier material must go into the gasoline fraction to make it follow exactly the New Navy curve.

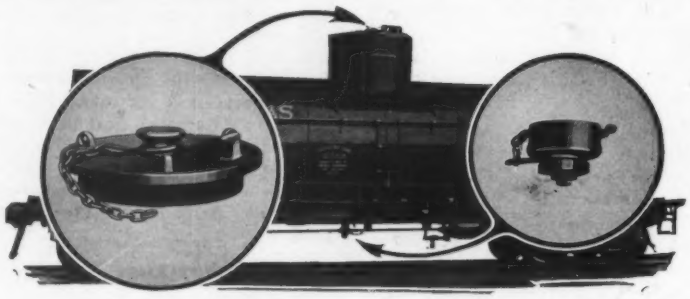
The best results that can be obtained with a dephlegmator or any combination of dephlegmators are little better. Differences of 80 to 90° F. between the 90 per cent point and the end point on the Engler curve of the distillate can be obtained for a once run product and the yield is probably 60 per cent of the total available material below 437°. Vaporizing an excess of vapor in a still and then running this vapor to a dephlegmator to reduce the end point gives a product not very different from that which would be obtained by taking off less vapor in the first place. But it is not worth while to give further proof of this. You all know that simple distillation will not give New Navy gasoline in one running, nor will any arrangement of dephelgmators or condensers. The problem calls for the use of our third method of separation: that is, counter current scrubbing. And once we go to counter current scrubbing or fractionation in a tower, we can get any product we want, providing first, that is, that it is in the crude; second, that the tower is tall enough and properly arranged; and third, that we are willing to supply the very small extra amount of heat required. (If this heat is not supplied to a tower, many times the amount must be supplied for re-running.)

With the simplest arrangement of tower imaginable, one in which the vapor from a still goes in at the base and comes out at the top and to the top of which the proper amount of reflux liquid is supplied, this reflux liquid coming out the base as a secondary product, it is possible to get gasolines of any desired end point with an Engler curve in which the difference between the 90 per cent and the end point is 50 to 60° F. In other words, such a tower, if properly designed, will give within ten or fifteen per cent of the maximum possible yield of new Navy gasoline from any given crude.

By making minor modifications in the arrangement of this tower, a heads products, the Engler curve of which will fall directly on the New Navy curve, can be obtained. In fact, a curve flatter than the New Navy curve can be obtained by using a little more heat.

Many modifications and complications of the bubble tower can be made so that almost any desired products can be obtained in one running of a crude. With a comparatively simple arrangement, we have been able to make products, the Engler curve of which will pass through any two specified points.

Pittsburgh, Pa.—John B. Corrin, assistant general manager of the Hope Natural Gas Company, a subsidiary of the Standard Oil Company (New Jersey), has been elected vice president and general manager of the company



Better and Safer Products

For YOU, Result From Careful Handling of Details

In manufacturing our stock specialties—dome covers and outlet caps, or equipment built to order—our success depends on the care given to every manufacturing operation.

Everything is planned efficiently for the best results —YOU are constantly protected. Our long established reputation is squarely behind everything we produce.

That positive assurance means a saving to you, both in time and money. Our quality standards and systemized methods are at your disposal.

Orders by Wire or Letter Promptly Handled

Specialists in Brake Shoes, Gray Iron Castings, Plate Work, Beams, Sheet and Structural Steel.

OIL WELL RIG IRONS AND REFINERY EQUIPMENT

Western Iron and Foundry Co.

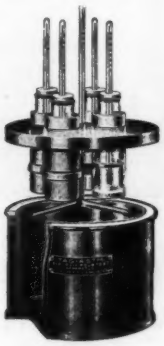
Wichita, Kansas

TAG OIL-TESTING INSTRUMENTS

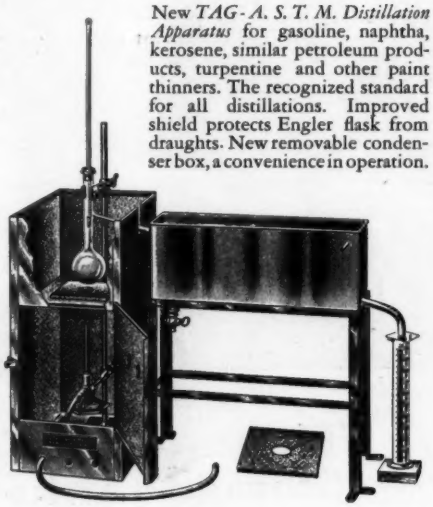
STANDARD WHEREVER OIL IS TESTED. True today, as it was when oil-testing began. True of the TAG Line as a whole; and of each and every TAG instrument.

Improved Form TAG-A. S. T. M. Cleveland Open Tester for determining flash-and fire-points. Conforms exactly to specifications. (Serial D-92-24.)

TAG-A. S. T. M. Cloud and Pour Test Apparatus. The standard "cold test" apparatus. Four determinations can be made simultaneously. Compact and convenient.



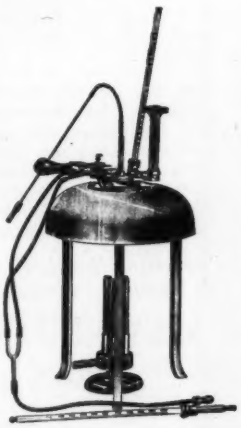
New *TAG-A. S. T. M. Distillation Apparatus* for gasoline, naphtha, kerosene, similar petroleum products, turpentine and other paint thinners. The recognized standard for all distillations. Improved shield protects Engler flask from draughts. New removable condenser box, a convenience in operation.



THE TAG LINE IS COMPLETE. These are only a few TAG instruments, picked more or less at random, as for a show-window. The full TAG Line of standard instruments includes devices for the making of *every test*—for making it in exact accordance with standard procedure. Every TAG instrument conforms to official specifications. And, needless to say, every TAG instrument represents the utmost in precision, durability and operating convenience.

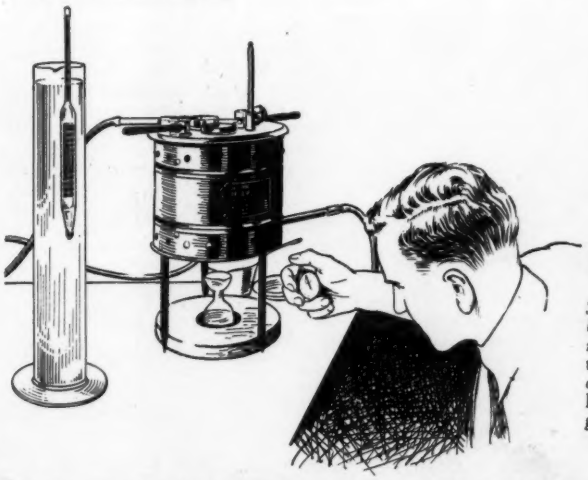
Send for Catalog B-699

TAG-A. S. T. M. Standard Pensky-Martens Closed Tester for determining the flash points of fuel oils. Design and construction standard; workmanship superior. (Serial D-93-22.)



Saybolt Standard Universal Viscosimeter. Electric, gas or steam heating equipment. Turn-table stirring arrangement. Bath temperature accurately regulated regardless of means of heating. Adopted by A. S. T. M., U. S. Gov't, N. P. A. and A. P. I.

Thermometers, hydrometers, etc., in all ranges, sizes and forms. *Glassware, accessories, etc.*



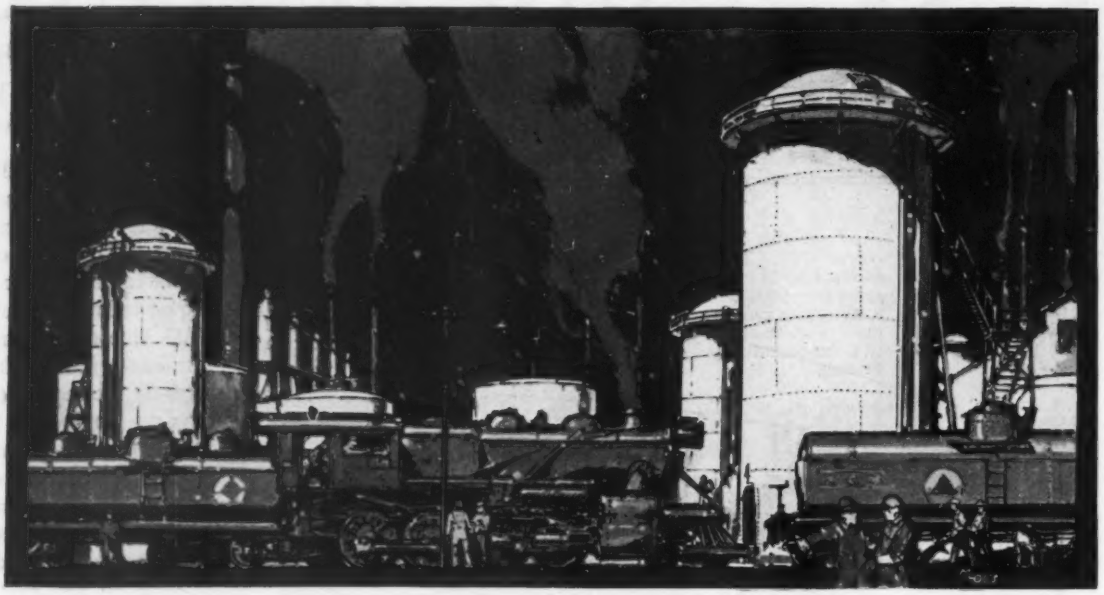
Saybolt Standard Universal Chromometer for determining the color-shades of kerosene and gasoline.

C. J. TAGLIABUE MFG. CO.

18 TO 88 THIRTY-THIRD ST., BROOKLYN, N.Y.

Insist on Mercury Thermometers with the TAG-Hespe RED Reading Column

SINCE 1769



A Partial List of Cook Products Manufactured Especially for the Oil Industry

Red Lead Paints
Rust Inhibitive Brown
Blue Sublimed Lead
Galvanized Iron Primer
STEEL-KOTE METAL PAINT
Truck and Underframe Black
Hard Drying Black
Stencil Paste
Carbon Black
Interior Tank Paint
Graphite Paints
Red Oxide Paint
Metallic Brown Paint
GAS PROOF TANK PAINTS
Aluminum Tank Paints
Practical Painters' Paint
Floor Enamel
Barrel Paints
Drum Enamels
Industrial Service Enamels
Machine and Engine Enamels
Roofing and Waterproofing Cement
Asbestos Fibre Black Roof Paint
Still Head Aluminum Paint
Black Stack Paint
Acid and Alkali Resisting Black
Boiler and Still Setting Cement
Underground Pipe Line Paint
Gas Proof Enamel
Permanent White Paste
Auto and Truck Enamels
Varnishes

Thousands of Tank Cars and Storage Tanks are now telling a Story of Costly "Economy"

What Story Will Yours Tell Next Year?

THE impetus just given the Oil Industry is resulting in the placing of thousands of idle tank cars, storage tanks and other equipment back into active service. Much of this equipment is telling a dramatic, timely story of costly "economy." Protection—paint—for much of this equipment had been bought by the barrel, not by the experience and manufacturer's name back of it. Vibration, expansion and contraction, abrasion and weather opened the door to the Metal Marauders—Rust, Decay and Depreciation.

Will you let these three vandals repeat their deadly work again through a failure to specify the paint products especially manufactured for the oil industry by a company with years of experience and a conscientious policy of making paint worthy of advertising under the maker's name? The Cook Paint Company, with a thorough knowledge of the problems of paint protection for the oil industry, offers a special product for every need—and at a fair price which brings real economy with its resultant service and durability.

Buy the certain protection of Cook products. Let us answer your painting problems with superior paints and our compiled data and valuable advice on paint selections. Cook protection proves real insurance against the three Metal Marauders—Rust, Pitting and Corrosion.

Write today for the interesting Booklet: "Cook's Paints for the Oil Refining Industry."

COOK PAINT & VARNISH CO.

Kansas City, Mo.

Omaha Tulsa Dallas Fort Worth
Oklahoma City Denver Wichita

COOK'S
PAINT AND VARNISH PRODUCTS

Reclaiming Lube Oil Means Large Saving

North Texas gasoline plant has continuous system of treating used gas engine lubricating oil

By H. H. King
Staff Representative

Eastland, Texas. — The continuous system of treating gas engine lubricating oil is being used more extensively in natural gasoline manufacturing plants as a means of economizing on lube consumption and adding to the efficiency of plant operation. The Arab Gasoline Corporation's Hise plant near Eastland has enjoyed nearly a fifty per cent reduction in lube costs within one year with the aid of an installation of continuous centrifuge system of treating engine crank case oil along with the normal improvement in plant efficiency. During the three months period prior to the installation of the continuous centrifuge system, this plant's ten 160 H. P. Cooper engines showed an average lube oil cost of .0001325 cent per horsepower hour, while during the three months after the new system was put into service the cost of oil per horsepower hour amounted to .0000871 cent, thereby making a saving of .0000454 cent in costs of lube per horsepower hour.

The replacement of the batch method by the continuous centrifugal treatment of crank case oil provides a constant supply of clean oil for the engine bearings, and all impurities are removed as fast as they are introduced into the oil. Plants operating on the batch system usually permit the oil to remain in the engine crank case for months without making a complete change of oil, and during this period carbon, sand, water, dirt and other impurities are collecting from day to day and placed in direct contact with the bearings.

The average plant operator exercises great care in selecting the best grade of lubricants for his particular use, and after filling his requirements the next move is to keep this oil in the best of condition as long as it is in service, as well as to hold down the cost of the service. The continuous system of re-conditioning crank case oil keeps the lubricant serviceable over a longer period, and at the same time reduces plant maintenance costs through replacement of bearings and shutdown losses.

In connection with the process employed by the Arab Gasoline Corporation for the treatment of gas engine lubricating oil, the lubricant gravitates from an overhead tank through common header and from this header to each individual engine of the battery. A stream of oil is constantly fed to each engine. All of the drain lines from the engine crank cases are connected into a common header and then to sump tank which is set below floor level. As the oil is fed through sight oilers in regulated quantities through the top of the engine it gravitates on out of the bottom of the crank case carrying all impurities with it.

A small rotary pump is used to retrieve the dirty oil from the sump, forcing it through an improvised tubular heat exchanger and on into a No. 6 Sharples Super centrifuge, where all traces of impurities are removed. This machine develops a centrifugal force amounting to approximately 13,900 times that of gravity. The heavy suspended solids are retained in the rotor of the machine while any water present is continuously discharged to the sewer. A second pump takes the clean oil from the centrifuge and lifts same into the overhead engine feed tank.

Lubricating oil reconditioned at the Arab plant is analyzed at regular intervals, and the specifications of the oil are kept up to requirements at all times.

A properly installed continuous centrifuge system is automatic, and can be had in three styles of drive—steam turbine, electric motor, or belted speed transformer. When first installed the amount of solids removed makes the cleaning of the rotor necessary quite often, but after all the oil has been through the machine once the rotor will only need cleaning about once every two or three days.

Data on lubricating oil consumption taken from the operation of ten 160 H.P. Cooper engines at the Hise plant of the Arab Gasoline Corporation, Eastland, Texas, in conjunction with the continuous centrifugal treatment of crank case oil during 1924 is shown below:

Month—	% H.P. Hours	Cost of Oil Per H.P. Hour	H.P. Hours Per Gal.
January	98.10	.0001843	2107
February	98.04	.0002518	1499
March	99.18	.0001742	2229
April	99.65	.0001179	3276
May	99.40	.0001371	2823
June	99.67	.0001384	2793
July	99.36	.000122	3134
August (*)	99.60	.000126	3036
September	99.30	.0000859	4477
October	99.69	.0000888	4333
November	99.20	.0000867	4398
December	99.40	.0000899	4293

*Continuous centrifugal system installed late in August.

No. 6 Sharples Super Centrifuge installed at the Arab Gasoline Corporation, Eastland, Texas. Two ¼ Viking pumps are shown behind the centrifuge. They are used by pumping dirty oil to the centrifuge end for elevating clean oil to the overhead supply tank.

Corrosion Makes Big Inroad on Profits

(Continued from page 28)

running 120,000 barrels of crude to necssitate replacement of all of the 2 inch tubes. At other times the condenser would last much longer, but the general impression was that it paid to use the ammonia not only on account of the saving in maintenance cost, but also on account of the saving in time by having to shut down much less frequently for repairs.

2nd—We may use corrosion resisting material for our condensers, especially those where water condenses from among the oil vapors. This is the reason that cast iron is generally found more satisfactory for condensing coils than is either wrought iron or steel. However, when using so called high speed condensers with cast iron shells and admiralty bronze tubes it was found that the shells corroded rather rapidly and after a year or so the iron became so soft that it could be cut with a knife. This of course without the use of ammonia inasmuch as the latter has a distinct chemical action on copper and it was therefore thought undesirable to try it. It was therefore decided to replace those condensers with all steel apparatus and return to the use of ammonia. Even if the effect of hydrochloric acid on the condensers would not be severe, it would merely displace the trouble to the rundown lines, water traps, loolbox, tanks, etc.

3rd—With regard to the conditions favoring this form of corrosion, it will hardly be possible to carry out the distillation at so low a temperature, or to dry the crude to such an extent, that hydrochloric acid is not formed. Similarly we cannot very well avoid the condensation of water together with the oil vapors, and it appears like we have to look elsewhere for our remedies.

With regard to sulphur corrosion: this is much less troublesome with Mid-Continent crudes than it is with Mexican and other high sulphur crudes. Very little appears to be known as to the chemical mechanism, whether the action is by hydrogen sulphide, organic sulphur compounds, or intermediate products formed by oxidation or otherwise. It has been noted that sulphur corrosion is distributed more evenly over the metal, whereas hydrochloric acid corrosion more usually gives rise to pitting.

Undoubtedly other corrosive compounds, such as organic acids occur—but our knowledge of them and their effects in Petroleum Refining is very limited.

Considering now the corrosion troubles encountered in **Cracking Plant** operation; we find similar ones as are met in the topping plants, but accentuated by the special conditions of high temperature and high pressure. The high pressure in itself is not so much a contributing factor, but it makes the whole problem more serious on account of the results which may follow in case corrosion reduces the strength of the apparatus beyond safe limits. Furthermore, in view of the large amount of mechanical cleaning which generally has to be done symptoms of corrosion may be aggravated to high temperatures is more likely to induce structural changes in the metal, apart form corrosion, than is the case in topping plants.

First considering again the heating surface corrosion, I can refer to what has been said under topping plants, with the addition that in cracking the deposit of course is mostly coke, the remedy therefore periodical mechanical cleaning, although proper furnace construction is a very important point. Corrosion of the internal surface is here found more than in topping, and appears to be mostly due to sulphur compounds.

In the remainder of the appartus sulphur corrosion also plays an important part. In one instance, the main vapor line in a Cracking Unit failed by explosion after the unit had run 150,000 barrels of different charging stocks, about half of which was of Mexican origin. The main vapor line of another unit which had run 95,000 barrels, mostly of Mid-Continent origin, was found to present practically no evidence of corrosion. It is very important that vapor lines, as well as all other parts of the apparatus, be frequently inspected. Where direct visual inspection is not possible, the metal should be hammered, or still better drill holes will allow direct measurement of its thickness, and these holes can afterwards be welded up.

As another instance, the expansion

WIRE AKIN
for
"ALL GRADES OF NATURAL GASOLINE"
Swift Shipments from
OKLAHOMA
TEXAS LOUISIANA
We make and market all grades of natural gasoline. You can get what you want, right on the dot, when you entrust your order to Akin.
THE AKIN GASOLINE CO.
Exchange National Bank Building
TULSA :—: :—: OKLAHOMA

If you and "the refiner across the road" were purchasing the same type of crude oil and his skimming plant was recovering twice as much gasoline per barrel as yours, you would certainly sit up and take notice In fact, if you didn't, you would soon be out of the running

The same holds true of the Dubbs Cracking Process as compared with any other and it holds true of the refiner who has the Dubbs Process compared with the refiner who has none or even has some other process

It is a pleasure for us to know that every refiner who has installed the Dubbs Cracking Process is getting far greater value than we promised and the licensee of the process is even happier than we

We knew it, but it is a pleasant surprise to him

Universal Oil Products Company
Owners of the Dubbs Process
312 South Michigan Ave
Chicago Illinois

chamber of a Cracking Unit was found to present very little evidence of corrosion after the unit had put through 90,000 barrels, most of which was Mid-Continent Gas Oil and Fuel Oil. The original thickness of the chamber wall was ¾-inch and this had diminished in some places to 11/16-inch which, however, may have been mostly due to mechanical wear from frequent cleaning even if we overlooked the possibility that the original thickness may not have been quite the same in all places.

Hydrochloric acid corrosion may also be encountered in Cracking Plants, especially when running crude oils After an experiment on heavy Smackover Crude some of the water in the pressure distillate receiver was analyzed and found to contain 4.84 grams per liter of chlorine, in the form of iron chloride and hydrochloric acid. The same water contained .071 gram of sulphur per liter, most of the sulphur no doubt having escaped in the form of hydrogen sulphide, with the gas.

A peculiar development is the corrosion of steel pans located in the lower part of the dephlegmator of certain Cracking Plants. The exact cause or conditions governing this corrosion is not yet known. Inasmuch as the remainder of the dephlegmator does not appear to be measurably affected, this problem is not of very great importance.

Summarizing, I believe that when cracking most Mid-Continent gas oils and fuel oils corrosion will not be a very serious problem, although I wish to stress the absolute necessity of frequent inspection. When cracking Mexican oils, and no doubt others, corrosion may prove to be a very expensive problem, and for these cases the possibilities of using metals or specially treated steel should be investigated

In the **Treating Plant** sulphuric acid corrosion is familiar and similar to that occuring in other industries using or manufacturing this acid. In this connection I only wish to point out that I noted in a recent article [6] a recommendation that blow cases for concentrated sulphuric acid should be lead lined. As far as I know this has not been general practice. Certain blow cases and acid tanks which have been in use for over six years without lead lining and without any sign of trouble have recently been inspected and tested to determine their exact condition. There was no evidence of corrosion and only a few very small leaks were found. While it appears to me that lead lining is unnecessary, a periodical inspection is certainly not superfluous There are a great many other corrosion problems in connection with Petroleum refining, and I do not make any claim for completeness in covering the above more or less scattered points.

[6] National Petroleum News, Vol. 27, No. 2, page 62.

the ***Portable***
GAS ABSORPTION PLANT
with 2000 gal. capacity!

The "Southwestern" is the first successful Portable Absorption Plant consisting of standard equipment throughout, which can be transported by freight car or truck.

It is guaranteed to produce 2000 gallons of gasoline per day, and has a maximum gas capacity of 3,000,000 cubic feet at 35 pounds pressure. Absorption oil circulation 25 gallons per minute. Efficiency—90% on charcoal test of head gas when operating on gas containing one gallon or more per thousand cubic feet.

This compact, efficient plant was designed to meet the producer's needs in fields where the life of the gas was of undetermined quantity and length. Its popularity has already been decided by orders on hand.

Detailed information will be furnished on request.

Southwestern Engineering Corporation
1221 Hollingsworth Building
Los Angeles, California.

HYDROMETERS
Thermometers
Hydrometer Jars

As specialists in the making of scientific instruments for Refinery use, we have perfected an hydrometer having a thermometer above the gravity scale.

This feature eliminates the removal of the hydrometer for temperature readings.

Any type of thermometer or hydrometer with special range, to order.

A. P. I. Standard

Literature?

THE JAMES BERG MFG. CO.
3707 Twelfth Ave.,
Brooklyn, New York

RECENT REFINERY PATENTS ISSUED

BY STAFF REPRESENTATIVE

Washington, D. C.—The following patents of interest to the refinery industry were granted by the United States Patent Office during the month of February:

No. 1,524,818, granted February 3 to Gustav Egloff and Harry P. Benner, Independence, Kansas, assignors to Universal Oil Products Company, Chicago, for an apparatus for treating hydrocarbon oils consisting of the combination with a still, of an annular heating element extending therethrough, means for introducing oil into said still comprising a flushing member, having a plurality of nozzle elements extending circumferentially around the heating element, and adjacent the latter, a supply pump and connections between said pump and flushing member

No. 1,525,016, granted February 3 to James W Weir, Fillmore, Calif., for a process of separating sludge from oil which consists in introducing into a centrifuge machine a mixed oil and sludge and separating the sludge from the oil by centrifugal force, thus throwing the sludge to the outer periphery of the machine, introducing into the machine while in operation a solvent for the sludge and delivering it into the centrifuge machine at its outer periphery, and continuously discharging the oil and the dissolved sludge at the same time from the machine.

No. 1,525,281, granted February 3 to Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Company, Chicago, for a process for treating hydrocarbon oil consisting in passing a stream of oil in a single passage through a continuous cracking coil where said oil receives its cracking heat, in introducing the heated oil to an enlarged chamber where substantial vaporization occurs, in removing vapors from said chamber and introducing said vapors to a dephlegmator, in aiding in the condensation of the insufficiently cracked vapors passing through said Dephlegmator, in discharging unvaporized residue from said enlarged chamber without again admitting said residue to said cracking coil, in forcing under an applied mechanical pressure intermingled reflux condensate and charging stock from the dephlegmator to the inlet side of said cracking coil for passage therethrough and maintaing the oil undergoing conversion under a super atmospheric pressure.

No. 1,525,409, granted February 3 to Hippolyte Neveu, Paris, France, for a process of continuous solidification of hydrocarbon liquids consisting in supplying in a continuous manner and in small quantity the liquid hydrocarbon and the emulsifier in contact with a mass of already emulsified hyrocarbon which is mixed in a contiuous manner by an agitating device, the emulsion being simultaneously evacuated in a continuous manner and in a quantity corresponding to the quantity of hydrocarbon and emulsifier simultaneously admitted.

No. 1,525,916, granted February 10 to Edgar M. Clark, New York, assignor to Standard Development Company of Delaware, for a method of converting hydrocarbon oils into lower boiling point hydrocarbon oils which comprises heating the oil to be converted to a temperature above 680 to 700° F. at a rate such that no substantial proportion of desired low boiling point products is formed during said heating, compressing the heated oil material to a pressure at which the unconverted oil is substantially entirely in the liquid state and retaining the heated oil material under such pressure without reduction in temperature below 680 to 700° F. to effect substantial conversion thereof.

No. 1,526,010, granted February 10 to Max G. Paulus, Whiting, Ind., assignor to Standard Oil Company of Indiana, for an apparatus for distilling hydrocarbon oils consisting of a still setting, a bulk supply container mounted thereon, downwardly inclined circulating tubes mounted in the heated zone of the setting, headers at each end of the tubes, means connecting the headers with the container, and means for injecting gas into the lower ends of said tubes in an upward direction.

No. 1,526,534, granted February 17 to Raymond Auguste Dornes, New York, assignor to Dorwin Manufacturing Co., Phoenix, Ariz., for a process and apparatus for refining oils. The method of refining oil consists in completely vaporizing the oil by heat, partially purifying the oil vapors by a series of expansions and reheatings, forming a mixture of steam and such partially purified oil vapors, further purifying the mixture by a succession of expansions and reheatings, and subjecting the mixture to different temperatures and pressures to condense products therefrom. The apparatus consists of a condensor having a single chamber, means for introducing oil vapors into said condensor, means for maintaining zones of different temperature in said chamber, and means for collecting the condensation product therein. The method of refining mineral oils consists in forming a mixture of oil vapors and steam, introducing alcohol into the mixture and condensing the mixture.

No. 1,526,665, granted February 17 to Lazar Edeleanu, Charlottenburg, and Wilhelm Hess, Lichterfelde, Germany, for a process of purification of hydrocarbons by means of liquid sulphurous acid which consists in the systematic subjection of the primary material to extraction in batches at a temperature well below the vaporization point of sulphurous acid in a number of successive stages with mother liquors arising from previous extractions of different degress of saturation commencing with a liquor having the highest degree of saturation followed by a final extraction with pure liquid sulphurous acid, whereby the loss of hydrocarbons in solution with said undesired ingredients is lessened.

No. 1,526,834, granted February 7 to Thomas S. Cooke, Whiting, Ind., assignor to Standard Oil Company of Indiana, for a method of distilling petroleum oil, comprising a mixture of fractions having a relatively wide range of boiling points, which consists in passing such oil in a continuous stream through a series of stills maintained at increasing temperatures in the direction of flow of the oil, subjecting all of the vapors passing from each still to the action of a fractionating column, whereby all vapors condensing below a predetermined temperature are condensed in said columns, refluxing to the stills the vapors condensing in their respective columns in countercurrent to the vapors issuing from said stills, and separately condensing and collecting the vapors which escape condensation in the columns, whereby there is obtained from the oil in a single distillation a maximum yield of distillate having a minimum end boiling point.

No. 1,526,907, granted February 17 to Wilfred Fourness, Pasadena, Calif., assignor of two-thirds to S. Hazard Halsted, Ezra S. Gosney and Guy R. McComb, all of Pasadena, for a process of treating mineral oil comprising subjecting mineral oil to a preliminary vaporization to separate the lighter products, then subjecting the mineral oil to a cracking temperature, heating the mixed vapors from the mineral oil temperature, cooling the mixed vaporous products sufficiently to condense the heavier fractions thereof, again subjecting the vaporous products uncondensed at the cooler temperature and fractions mixed therewith to a cracking temperature and finally condensing and separately collecting the heavier and lighter distillates, the products from the original mineral oil being led directly into a final condens-

THERE IS A TYCOS OR TAYLOR TEMPERATURE INSTRUMENT FOR EVERY PURPOSE

Tycos Temperature Instruments
INDICATING - RECORDING - CONTROLLING

Have you written for a copy of the new Tycos Catalog for the Oil Industry?

Ask for Part 1700 It's free

Taylor Instrument Companies
ROCHESTER, N. Y., U. S. A.
CANADIAN PLANT, TYCOS BLDG., TORONTO

1004

er separate from that employed for the collection of the heavier products, said lighter products being volatilized by steam generated incidentally to the intermediate cooling of said mixed vaporous products.

No. 1,527,836, granted February 24 to George J. Burns, Youngstown, Ohio, for an oil still including a double walled retort, a substantially conical cover plate fitting within the inner wall and provided with hooded discharge openings, a cover for the retort and cooperating with said cover plate to provide a condensing chamber, a condensing coil in said chamber, a draw-off pipe communicating with the condensing chamber, a hollow standard journaled in the cover and in the bottom wall of the retort, and carrying a plurality of hollow offset agitating arms, and a perforated steam pipe for conducting steam to said hollow standard.

No. 1,527,871, granted February 24 to Philip Heffler, Pittsburgh, Pa., assignor of one-half to Harry C. Simmons, Crafton, Pa., for an oil still consisting of a casing, a container supported in the upper portions of the casing, checkers in the casing beneath the container and spaced therefrom, heating means at one end of the casing, means for admitting air to the checkers, means for causing the products from said heating means to flow through either checker optionally thereby inducing air through the other checker, and means for causing the induced products to flow through the space above said other checker toward the other end of the casing, the induced products commingling with the products of the heating means and flowing therewith through said first checker.

Many Methods Used in Treating Operation

(Continued from page 15)

of bodies known as mercaptans. The mercaptans are oily liquids, not so easily removed as the gas, hydrogen sulphide. Before describing the various reactions I may illustrate, by reference to some of the better known substances, something of the nature of these bodies called mecaptans.

The carbon compounds, methane, ethane, propane, and similar substances are well known in the industry. Methane (CH_4) and ethane (C_2H_6) are the most prominent parent substances responsible for numerous thousands of compounds, are also known as methyl hydride (CH_3H), and ethyl hydride (C_2H_5H) respectively. The ethyl part is known as a radical and may form part of the name of closely allied substances; methyl alcohol (CH_3OH), ethyl alcohol (C_2H_5OH), and ethyl ether ($(C_2H_5)_2O$) are examples. Water when written H-O-H shows its relation to hydrogen sulphide H-S-H. An alcohol is of the type R OH; and ether R-O-R. As sulphur replaces oxygen in the water type substances it may do so in many compounds. The bodies R-SH are mercaptans, and C_2H_5SH is ethyl mercaptan.

Where a mercaptan is treated with caustic soda the sodium mercaptide is formed and as it is soluble in oil the mere addition of caustic soda does not sweeten. However, the addition of the Doctor solution, Sodium Plumbite, causes a percipitate and the clear oil is sweet, because the resulting lead product is dissoluble in the oil. When the heavy dark mass forms and is easily washed away with water, leaving a clear liquid, there is no need for adding sulphur, indeed additions of sulphur under such circumstances will simply dissolve the sulphur in the final product and thus prove detrimental. This mistake is often responsible for a bad corrosion test shown by some gasoline.

When the mercaptans are present alone, that is without sulphur, or hydrogen sulphide, the percipitate collecting on the surface of the Doctor solution, after its addition to the gasoline, is of a yellowish color. However, upon the addition of a pinch of powdered sulphur the color rapidly changes to black. These changes may be represented by:

$$\left.\begin{matrix} C_2H_5SH \\ C_2H_5SH \end{matrix}\right\} \text{plus } Na_2PbO_2 \text{ equals}$$

$$\left.\begin{matrix} C_2H_5S \\ C_2H_5S \end{matrix}\right\} \text{Pb plus S Na OH}$$

(Yellow)
(insoluble)

$$\left.\begin{matrix} C_2H_5S \\ C_2H_5S \end{matrix}\right\} \text{Pb plus S equals}$$

$$\left.\begin{matrix} C_2H_5S \\ C_2H_5S \end{matrix}\right\} \text{plus Pb S (black)}$$

(soluble in oil)

The diethyl sulphide is soluble in gasoline and therefore sulphur is not removed by this kind of treatment, although the product would pass sweet to the Doctor test. Sweetening does not always remove all of the sulphur from the gasoline, in fact the operation may take place without removing any of the sulphur. The only change is that of odor. The mercaptan has a distinctly bad odor, while the disulphide compound is almost free from odor.

The lighter distillates from crude and pressure distillates usually contain sufficient free sulphur to complete the reaction, but the kerosenes and higher fractions need additional sulphur, because the heavier mercaptans do not contain sulphur in the same proportion.

In this reaction it appears that the black percipitate aids in the change simply by its presence and the powdered sulphur is necessary for the formation of the black compound when treating such stocks as kerosene.

NATURAL GASOLINE

An Assured Supply of Guaranteed Grades

All Grades are Manufactured by Chestnut & Smith Corporation

GRADE DOUBLE "A"

Recovery.....Not less than 90%
End Point.....Not over 375° F
Gravity.....80.0 to 87.9° Be

GRADE "DOUBLE B"

Recovery.....Not less than 85%
End Point.....Not over 375° F
Gravity.....84.0 to 92.0° Be

GRADE "A"

Recovery.....Not less than 90%
End Point.....Not over 375° F
Gravity.....72.0 to 79.9° Be

GRADE "B"

Recovery.....Not less than 85%
End Point.....Not over 375° F
Gravity.....76 to 83.9° Be

GRADE "C"

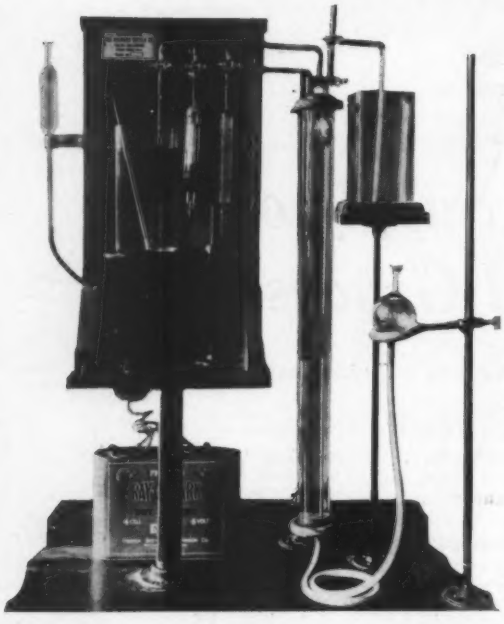
Recovery.....Not less than 78%
End Point.....Not over 375° F
Gravity.....80.0 to 90.0° Be

These are the Official Specifications for Natural Gasoline as adopted and issued by the Association of Natural Gasoline Manufacturers—October 1, 1924.

CHESTNUT & SMITH CORPORATION

GENERAL OFFICES-CHESTNUT & SMITH BLDG.- TULSA, OKLA.

You Can Balance Your Still Efficiency Against Your Absorber Efficiency By Using



The R S
Control Apparatus
for
Gasoline Absorption Plants

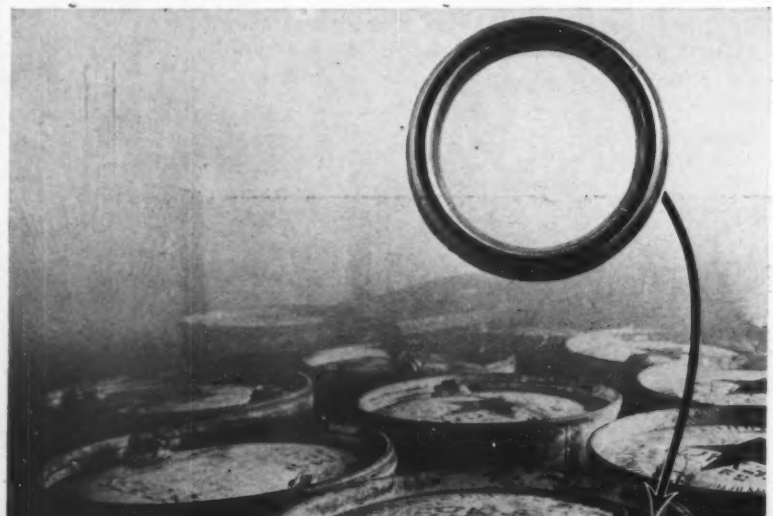
In Use By

Phillips Petroleum Co., Wentz Oil Corporation, Skelly Oil Co., Roxana Petroleum Corp., (Gas Department), Landreth Gasoline Co., McMan Oil & Gas Co., Baltic Gasoline Co., and many others.

CIRCULAR ON REQUEST

The Refinery Supply Co.

4th and Detroit Sts.,
TULSA, OKLAHOMA



GOETZE
Metal Corker Gaskets

for

Steel Drums
Tank Cars
Pipe Lines

MEAN MONEY SAVING

NO LOSSES THROUGH LEAKAGE

CAN BE USED OVER AGAIN

Goetze Gasket & Packing Co.

28 Allen Avenue
New Brunswick,
New Jersey

Big Gasoline Plant Built In Gilcrease-Papoose Field

Bartlesville, Okla., March 17.—In the Papoose oil field, about seven miles west of Wetumka, Oklahoma, the Phillips Petroleum Company is completing a gasoline plant which it is said will be the largest in the world from the standpoint of volume of gas handled daily.

The plant will handle approximately 30 million cubic feet of gas daily, and the production of gasoline will run somewhere between 30 and 40 million gallons daily.

Compressor equipment consists of 20 Clark 165 H.P. Twin Gas Compressors. The entire battery of compressors is now installed and the walls and roof of the compressor building will be completed within a few days.

With the completion of this plant, the Phillips Petroleum Company will be one of the two, if not the largest producer of natural, or casinghead gasoline in the world. The company now has a plant equipped with 10 Clark 165 H.P. units in the Wewoka field which is only a short distance from the Papoose field. The new plant will give the company the two largest plants in this district, with a total estimated production of approximately 60 to 70 thousand gallons per day.

Within the past year, the Phillips Petroleum Company has purchased a number of large gasoline plants, both in Oklahoma and Texas. The company has one of the best organized gasoline plant engineering, research, and operating department forces ever perfected.

Foster Completes Plant

Dean E. Foster, Tulsa engineer and manufacturer of the Foster Baffle, has recently completed his gasoline plant one and one-half miles southwest of Deer Creek in Grant County, Oklahoma. The plant is now producing 3500 gallons per day with only one unit in operation.

Foster's plant treats the gas which supplies the city of Enid, Oklahoma, and its industries through the medium of the Deer Creek Pipe Line Company eight-inch welded line running from the Deer Creek gas field to the city.

The new plant has a capacity of 15,000,000 feet of gas per day with a daily output of approximately 8000 gallons of gasoline when run to capacity. The gas is being treated under a pressure ranging from 200 to 425 pounds per square inch.

Transcontinental Making Improvements at Plants

Pittsburgh, Pa.—Improvements and extensions are under way at the refineries of the Transcontinental Oil Company at Bristow and Boynton, Oklahoma, and at Fort Worth, Texas. When completed these improvements will entail an expenditure of upwards of $200,000.

The Bristow plant of Transcontinental has a rated capacity of 6000 barrels daily and is having added four additional stills that will bring the completed units up to 10. Three new crude stills are being added at the Boynton plant of the company that has a rated capacity of 3000 barrels daily. This will give the plant there some 13 stills.

The Fort Worth refinery of Transcontinental is having its capacity of filtration apparatus doubled and when completed the refinery will be equipped with 24 stills. The Fort Worth plant has a rated capacity of 5000 barrels daily.

New Concern Takes Over Moore Plant in Kansas

Arkansas City, Kans.—The Arkansas City Refining Company has been organized under the laws of Kansas and has leased the refinery here that has been operated by the Moore Refining Company. George N. Moore of Chicago, president of the Moore Refining Company, has retired from the management of the plant and E. R. Perry of Tulsa, former vice president and general manager of Cosden and Company, is in charge as president and general manager.

Other interests identified with the Arkansas City Refining Company include the Bell Oil and Gas Company of Tulsa. Mark Finston of Tulsa is vice president of the new company and R. C. McCay, also of Tulsa, is secretary and treasurer.

The plant at Arkansas City has a rated capacity of 6000 barrels daily.

New Sinclair Plants to Be Ready By April 1st

Marcus Hook, Pa.—Actual operations at the new 10,000 barrel refinery here of Sinclair Consolidated Oil Corporation are expected to get under way about April 1. Virtually all construction and installation work has been completed and the plant now is being given a thorough testing out.

The Marcus Hook plant is equipped with the most modern refinery apparatus and is the last word in construction work of this kind. The equipment includes two batteries of high pressure stills and the Isom cracking process has been installed. Products to be turned out include gasoline, kerosene, furnace oil and bunker fuel oil. At full operation the plant is capable of turning out upwards of 6000 barrels daily of gasoline.

The plant of Sinclair at Sinco on the ship channel out from Houston, Texas, is a duplicate of the Marcus Hook plant except that the former has a lubricating plant in connection. While the Marcus Hook refinery has a rated capacity of 10,000 barrels daily it is equipped to handle approximately 30 per cent more crude under heavy load.

The Marcus Hook refinery can use as fuel coal or oil and its location on tidewater with ample wharfage facilities will enable it to receive and deliver raw and refined products. Its equipment includes tankage for crude and refined oils, a barrel plant, compounding plant and facilities for canning.

Cook Paint to Serve Refiner With New Store

Kansas City, Mo.—The Cook Paint and Varnish Company of Kansas City are opening a factory branch warehouse at 213 South Boston avenue in Tulsa. E. K. Morey of Kansas City is supervising the opening of the branch.

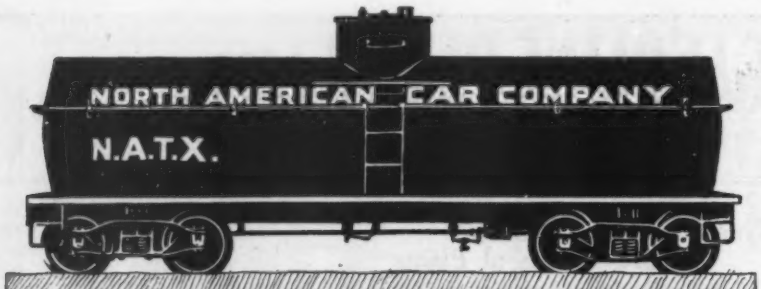
The company manufactures a complete line of paints, enamels, varnishes, etc., for oil industry and other lines and operates factories at Kansas City and Fort Worth, Texas, with branches at Omaha, Wichita, Oklahoma City, Dallas, Denver and Kansas City, Kan.

W. T. Brown and Company will be distributors of Cooks paints in the Tulsa territory. J. P. Ormsby of Kansas City is manager of industrial sales of the Cook Paint and Varnish Company.

Bayer Made Vice President

Tulsa, Okla.—Lloyd F. Bayer of Tulsa has been made vice president and general manager of the Tidal Refining Company, Tidal Western and the Tidal-Chelsea Refining Companies, subsidiaries of the Tide Water Oil Company of New York.

A. F. Garrett, also of Tulsa, has been made assistant general manager and will be in charge of sales for the companies. Both executives have been associated with the Tidal Companies for a considerable period and are well known in both the refining and natural gasoline industries.



A Profitable Resolution for 1925

Try North American Car Leasing Service to find out why so many shippers prefer it. Investigate the completeness of the fleet—the perfect condition of the cars—the bulk and loaded-car storage facilities. Write today for details.

NORTH AMERICAN CAR CO.
327 S. La Salle St. Chicago, Ill.

Southwestern Office:
Petroleum Bldg., Tulsa, Okla.
North American *car repair* service is prompt, reasonable in cost and always efficient

EDWARDS DROP FORGED STEEL VALVES. "FRAMANCO" FITTINGS

Edwards "Plug Type" Valve

Valves subject to working pressures of 500 lbs. and 1100° F. Fittings 10,000 lbs.

All sizes carried in stock.
Immediate shipment.

Maintenance Engineering Corporation
614 Second National Bank Bldg.
HOUSTON, TEXAS

Paragon Plans Expansion Program of $500,000

Toledo, Ohio.—The Paragon Refining Company of this city contemplates an extension program that will entail an expenditure of upwards of $500,000. The plans include the building of a new cracking plant and other necessary buildings with installation of latest improved equipment. The company's refinery here has a rated capacity of 8000 barrels daily.

Included in the new board of directors of the company are E. W. Edwards, W. C. Proctor, W. W. Freeman, H. W. Edwards, Charles Sawyer, Fred A. Geier and John Onwake, all of Cincinnati.

Despite the recent fire that visited the Toledo plant of Paragon, the company's business is holding up well and the outlook is an improved one.

400 Tank Car Orders

Pittsburgh, Pa.—Equipment orders recently placed by refiners and tank car companies include a contract for 400 tank cars that has been placed with the Standard Tank Car Company by the Quaker City Tank Line of Philadelphia. The company first ordered 200 cars and then gave another order for as many cars. Deliveries will start in about 30 days.

The cars will be of 8000 and 10,000 gallon capacity and will be equally divided.

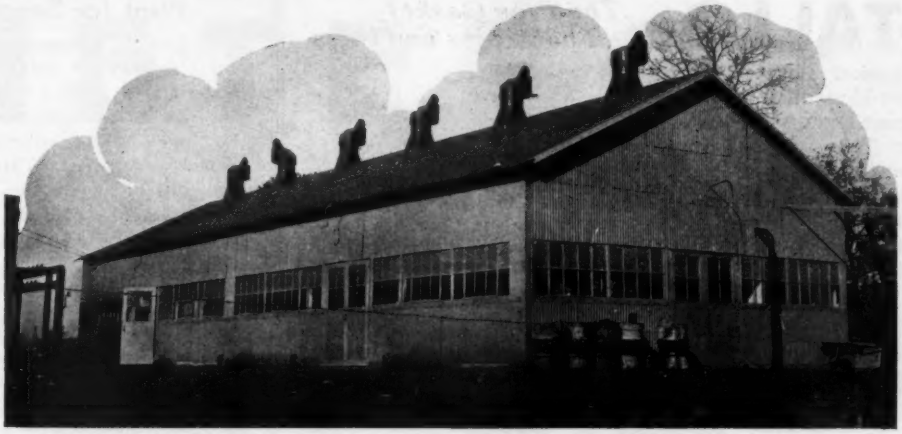
Phillips Buys Plants

Breckenridge, Texas. — The Phillips Petroleum Company has purchased the two natural gasoline plants operated by the Wooten-Hughes Corporation near Frankell, Stephens County for a consideration of $400,000, of which one-half was cash and the balance to be paid from one-half of the production of the two plants. These two plants are manufacturing in excess of 9000 gallons of gasoline daily, and are located within two and one-half miles of each other on the J. W. Harmon and J. M. Williams farms.

Fire Causes Damage

Tulsa, Okla.—The refinery of the Braden Company at Perry, Oklahoma, that was partially damaged by fire and explosion some time ago is to be rebuilt, according to company officials here. The capacity is to be increased and new equipment installed. The rated capacity has been 1000 barrels daily.

London, England.—Reports here are that the Vacuum Oil Company of New York is at work on the construction of a modern refinery in Czecho-Slovakia to be used for treating Polish oils.



STEEL BUILDINGS
FOR
GASOLINE PLANTS

DESIGNED, FABRICATED AND ERECTED TO MEET YOUR REQUIREMENTS

MOSHER STEEL AND MACHINERY COMPANY
DALLAS, TEXAS

HOUSTON STRUCTURAL STEEL COMPANY
HOUSTON, TEXAS

View of 6' x 60' Wyatt's Absorber Loaded for Shipment

We have the largest and most modern plate shop in the Southwest. It is equipped with the latest type of labor saving equipment including three electric traveling cranes, spacing tables, power riveting and flanging machines, and a welding department with large capacity for both gas and electric welding.

We carry a large tonnage of flat plates in thickness from 16 gage to ½" and flat circles for making flanged heads up to 120" diameter. We also carry flanged and dished heads from 24" diam. to 120" diam. and from 5/16 to ½ inch in thickness.

The total floor space in the shops is 100,000 sq. ft.

These facilities represent a large investment and are ayailable to serve you in the very satisfactory manner they have served practically every refiner and manufacturer of Natural Gasoline in this district.

We will appreciate your inquiries.

WYATT METAL & BOILER WORKS
Dallas, Texas

METALLO— *The Pipe Gasket That Stays and Pays*

THE gasket that will not blow out—that almost never wears out. The gasket that makes joints tight and keeps them so. The gasket that holds securely against the high pressures and temperatures that quickly destroy rubber and inferior metallic gaskets. The gasket that combines the lasting resilience of heavy, corrugated copper with the unequalled resistance to heat offered by the best of asbestos.

Reg. U. S. Pat. Off.

Metallo Valve Discs have a core or filler of compressed asbestos entirely enclosed with high grade copper, forming an elastic and resilient cushion on which the valve seats will close tightly without injury to either disc or seats. Metallo valve discs can be used successfully on high pressure steam, hot or cold water, gas, air, etc., and one of them will outlast at least six ordinary valve discs. They are made with either round or square holes, for use in Jenkins, Globe, Angle, Cross, Blow-off, Radiator or similar valves.

Metallo Gaskets have proved themselves under every condition of gasket service and have gained steadily in the confidence of engineers everywhere through years of freedom from pipe joint worries.

Do not be misled by gaskets of similar appearance—look for the name Metallo on the edge and make sure of getting the service that name guarantees.

Will you try Metallo Gaskets for 90 days at our risk?

Send for the Metallo Booklet.

METALLO GASKET COMPANY

244 Lafayette Street, New York, N. Y. Factory at New Brunswick, N. J.

FULTON DUPLEX
SENSITIVE VACUUM REGULATOR

On a system discharging gases to a line, under light vacuum, it is sometimes desirable to maintain atmospheric pressure.

For this purpose, we manufacture the DUPLEX VACUUM REGULATOR, which acts as a safeguard when used on the vapor lines connected to storage tanks, for the recovery of the gases, the purpose being to prevent the pulling of a vacuum.

WRITE US FOR FURTHER INFORMATION

CHAPLIN-FULTON MFG. CO.

28-36 Penn Ave., Pittsburgh, Pa.

Gilliland to Build New Plant for Smackover Pool

El Dorado, Arkansas.—The Gilliland Oil Company of Tulsa is purchasing materials to erect a low pressure absorption natural gasoline plant on its holdings in the Louann section of the Smackover district. This plant will be equipped to handle about four million cubic feet of gas daily, and will cost approximately $150,000. Contracts have been made with The Texas Company for gas production, besides that controlled by the Gilliland Oil Company. A yield of about two gallons of natural gasoline per thousand cubic feet is expected.

The Natural Gas & Petroleum Company of El Dorado is also reported to be contemplating the erection of a low pressure natural gasoline plant in the Louann field.

Gasoline Men Prepare for Spring Meeting in Tulsa

Tulsa, Okla.—Plans for staging the annual meeting of the Association of Natural Gasoline Manufacturers here on April 22-23 are well under way, according to A. V. Bourque, secretary of the Association.

The program will include instructive as well as entertaining features for all members who attend and it is expected that this year's sessions will be largely attended. The association has members not only in the Mid-Continent field but in the East and Middle West and on the Pacific Coast as well.

May Build Gasoline Plant

Winfield, Kans.—The J. A. Hull Oil Company of Tulsa is considering the building of a natural gasoline plant in the field east of Winfield in this state. The company has considerable acreage in this territory.

Work Progresses on New Midwest Installations

Casper, Wyo.—Work is progressing rapidly on the installation work connected with the setting of new stills that are replacing old ones in the various plants in this territory of the Midwest Refining Company and the Standard Oil Company (Indiana). The stills were shipped here from Illinois.

The new stills are replacing old ones in the refineries of the companies at Greybull, Glenrock and Laramie in Wyoming. The first named plant has a rated capacity of 8000 barrels, the Glenrock plant of the Continental (Mutual) a rated capacity of 10,000 barrels and the Laramie refinery a capacity of 3500 barrels. The Standard Oil Company (Indiana) plant at Casper has a rated capacity of 29,000 barrels.

METERS

FOR MEASURING PETROLEUM
AND ITS LIQUID PRODUCTS

Invaluable for securing accurate records of separate runs, or continuous flow. Practical and reliable for all refinery processes.

The EMPIRE

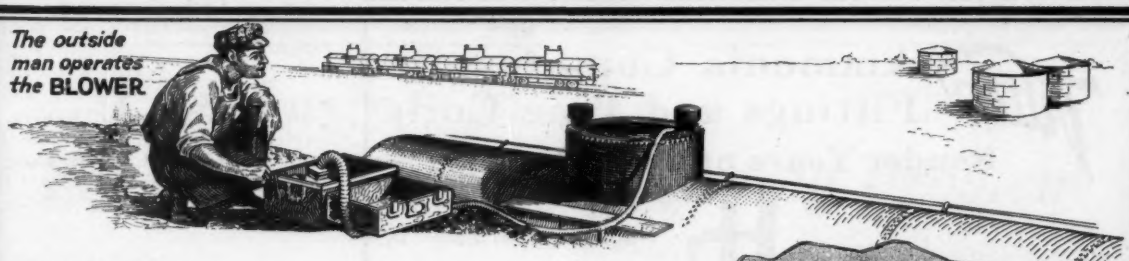
A meter that measures by positive displacement, produced by an OSCILLATING PISTON. This design is quite different from that of any other oil meter. The EMPIRE is not only highly accurate, but it stays accurate.

Made in all sizes, from 5/8" to 6". Both standard and high pressure types. Send for fully descriptive Circular 110-R.

NATIONAL METER COMPANY

299 BROADWAY, NEW YORK

CHICAGO BOSTON CINCINNATI ATLANTA SAN FRANCISCO LOS ANGELES

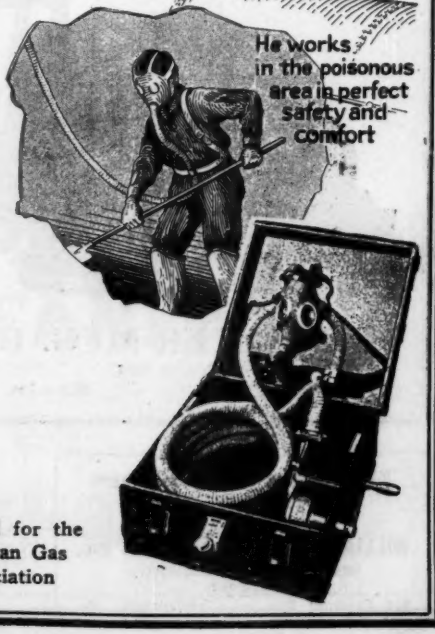


Feed him
FRESH-COOL-AIR

—and he'll work with greater ease, comfort and safety.

The M-S-A Standard
HOSE MASK

Supplies a continuous stream of fresh air to workers in Tank Cars, Oil Tanks, or in any confined gaseous space.



Send for Bulletin No. 99F for complete information on this and other types of Hose Masks

Mine Safety Appliances Co.
Chamber of Commerce Bldg. Pittsburgh, Pa.

Standard for the American Gas Association

Tank Car Repairs

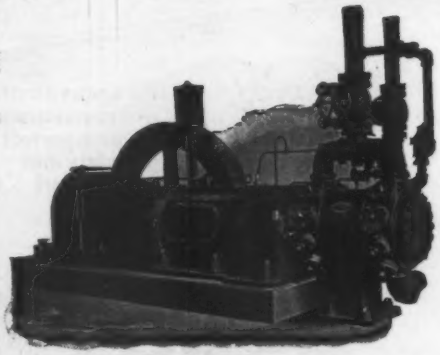
When you have trouble on any cars operating in Texas advise us and we will be glad to take care of your repairs whether large or small.

Lone Star Tank Car Company

Wichita Falls
P. O. Box 1445
Telephone 2157

Fort Worth
P. O. Box 754
Telephone Lamar 5466

Vilter **Ammonia Compressors Fittings and Pipe Coils**
Render Years of Reliable Service



Compressors built in several types and a great variety of sizes. Illustration is of a high speed type compressor.

Complete Data on Request

THE VILTER MFG. CO.
Established 1867
1152-1162 Clinton St. Milwaukee, Wis.

BRANCH OFFICE
413 Com'l Bank Bldg.
Houston, Texas

Electrically Driven Centrifuges
Hand Centrifuges
WRITE
WILLIAMS, BROWN & EARLE, Inc.
Manufacturers of Laboratory Apparatus
918 Chestnut St. Philadelphia, Pa.

CARBON BLACK
Channels, Angles, Roofing, Burner Pipes, etc. We are specialists in Carbon Black Building Material. Most of the buildings in Monroe, La., gas field and Stephens County, Texas, came from us.
WOODWARD, WIGHT & CO., LTD.,
New Orleans, La.

Mettler Entrained Combustion Gas Burners
— FOR ALL —
Purposes, Kinds of Gas, Pressures
LEE B. METTLER CO.
406 S. Main St. Los Angeles, Cal.

Tell them where you saw the ad

Magnolia Preparing to Build Booster Station

Ardmore, Okla.—The Magnolia Petroleum Company is now making preparations to construct a booster station to aid in the conveying of gas from the Magnolia lease in section 25-2s-3w, in the Graham field, to the company's gasoline plant.

A booster station is now being dismantled at Yale, Oklahoma, and the material shipped to the location of the new station. By the employment of the booster station, the capacity of the gasoline plant will be doubled and will give it an output of approximately 2500 gallons per day.

Standard Builds New Storage

Chicago, Ill.—The improvement program being carried out in the refining branches of the Standard Oil Company (Indiana) includes the construction of additional storage facilities at the Whiting, Indiana, works of the company. This increasing of storage will entail an expenditure of upwards of $1,000,000.

The Whiting plant of the Indiana company has a rated capacity of 43,000 barrels daily.

Lord Bradbury of Winsford, England, has been named ex-officio director of the Anglo-Persian Oil Company, Limited, succeeding Viscount Inchcape, resigned.

H. M. Breidenthal of Kansas City, former secretary of the White Eagle Oil and Refining Company, has been elected a director of the Lion Oil and Refining Company of El Dorado, Arkansas.

Oscar B. Cintas has been elected a director and vice president of the American Car and Foundry Export Company, succeeding the late Charles S. Gawthrup.

Dr. A. P. Bjerregaard, formerly chief chemist of the Empire Refineries, Inc., has been placed in charge of research work on special problems for the company, effective as of February 1, last. Arthur L. Davis, chief chemist at the Wood River refinery of the Standard Oil Company (Indiana), has succeeded to the position vacated by Dr. Bjerregaard.

Unbiased Advice

In the selection of temperature measuring and controlling instruments, there is sometimes doubt as to whether a thermo-electric pyrometer or a (gas, liquid or a combination of liquid and vapor filled) thermometer should be used.

There need be no doubt on this subject. The past fifteen years have shown beyond question the applications for which a thermometer should be used and those for which a pyrometer is necessary.

As makers of Brown Pyrometers "Most used in the world" and Brown Thermometers, having "Fifteen constructional advantages" we can supply you with either a pyrometer or a thermometer,—and there is no question that in either you would be receiving the utmost in an instrument of its kind, that money can buy.

Our advice is therefore unbiased. It is authoritative, because based on information gained in the practical working out of problems of temperature measuring and control of every phase of modern oil refining.

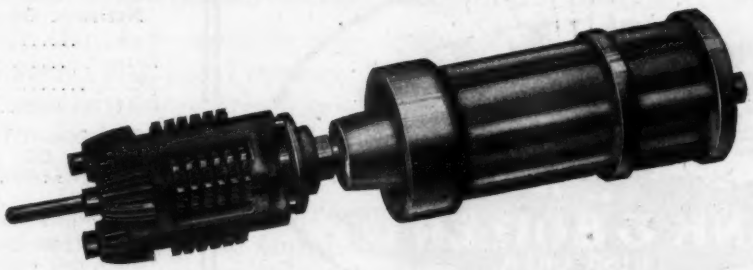
Your inquiry requirements will be carefully considered and completely answered.

Address THE BROWN INSTRUMENT COMPANY, 4537 Wayne Ave., PHILADELPHIA, Pa., ST. LOUIS, TULSA, HOUSTON, New York, Boston, Pittsburgh, Cleveland, Columbus, Detroit, Chicago, St. Louis, Birmingham, Denver, Salt Lake City, San Francisco, Los Angeles and Montreal

Brown Pyrometers AND Thermometers

Most Used in the World **15 Constructional Advantages**

The Answer to—
Your Cracking Still Cleaning Problem



ROTO TUBE CLEANERS

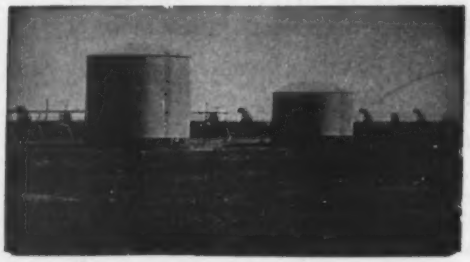
Direct inquiries to—

The Roto Company
HARTFORD, CONN.

÷ REFINERY SUPPLIES ÷

Refiners' Supplies

	March 20
Soda Ash light 58%.....cwt.	$1.38
Silicate of Soda 60 deg. bbls. . .....cwt.	1.70
Sal Soda wks .....cwt.	1.10–1.25
Caustic Soda 76% .....cwt.	3.10
Chloride of Lime solid .....cwt.	1.90–2.10
Sulphuric Acid 60 deg.tank cars f.o.b. shipping point per ton	9.50–11.00



'UNITED' GAS-TIGHT TANKS

—An Assurance of Long Service!

There is no secret as to the lasting quality of "United" Gas-Tight Tanks. They last longer because they are

—designed right
—fabricated right
—erected right

And, they are heavy plate, tight riveted, tight caulked—and guaranteed gas-tight.

Let us quote you on your requirements. Estimates promptly furnished without obligation.

UNITED IRON WORKS, Inc.

TULSA LOS ANGELES KANSAS CITY DALLAS

PIONEER TANK & BOILER Co. TULSA-OKLA

Oil Refinery Tankage

CRUDE and STEAM STILLS
CONDENSER BOXES
AGITATORS. TOWERS
HEAT EXCHANGERS
SEPARATORS
STORAGE and PRESSURE TANKS
ETC.

Steel Warehouse Dept.

STEEL PLATES. SHEETS
ANGLES. BARS. BEAMS
CHANNELS. RIVETS
BOILER TUBES
FLOOR PLATES
TANK FLANGES
STAY BOLTS
SMITH COAL and COKE

Immediate Shipments from Tulsa Stock

PHONE O-1146 OR WRITE BOX 1926.

Benzol—

90% tank cars	.22
Pure tank cars	.23 .24

Jobbers' Supplies

Vegetable Oils—

*Linseed, carloads, spot....gal.	$1.16
Less carload, spot.....gal.	1.16
5 bbls. or less, spot.....gal.	1.22
Boiled, tank, spot.....gal.	1.11
Boiled, carloads, spot.....gal.	1.19
Soya Bean, spot, tank.....lb.	.12

Animal Oils—

English Degras .....lb.	.04½
Domestic Degras bbls. carloads . . ..lb.	.04¼
Horse . .....lb.	.09½

Oleic Acids—

Dist. . .....lb.	.11¼
Saponified . .....lb.	.11½

Lard Oils—

Prime	
Winter	
Strained ...1 to 1½ ffa. 40/45c. t. lb.	.17⅞
Extra	
Winter	
Strained .....2 to 4½ ffa. 40/45c. t. lb.	.15½
Extra...4 to 5 ffa. 40/45c. t. lb.	.14½
Extra No. 1 .....7 to 10 ffa. 40/45c. t. lb.	
Extra No. 1 .....15 to 18 ffa. 40/50c. t. lb.	..
No. 2..22 to 23 ffa. 40/45c. t. lb.	.1
Prime Edible Tallow under 1½ ffa. 40/45c. t. N. Y.....lb.	.1(
Tallow acidless .....lb.	.1:
Lard Stearine .....lb.	.18
Oleo Stearine .....lb.	.11:

Neatsfoot Oil—

Pure . .....bbls.-lb.	.14½
Extra . .....bbls.-lb.	.13½
No. 1 .....bbls.-lb.	.13
Cold Pressed .....lb.	.17½

Fish Oils—

Menhaden Oil	
Light pressed .....gal.	–.78
White . .....gal.	–.83
Yellow bleached . .....gal.	–.80
*Herring, tankcars coast....gal.	–.40
Whale, ext. winter bleached gal.	–.80
Seal	Nominal

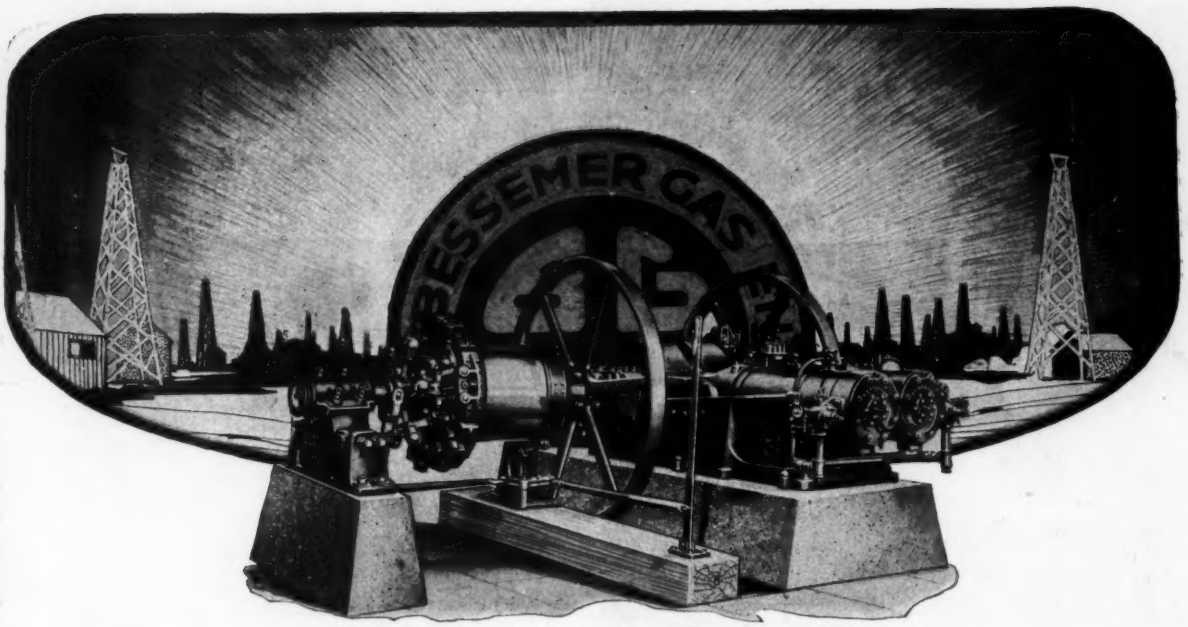
Naval Stores—

Turpentine, N. Y. .....gal.	.93
†Turpentine . .....gal.	.87½
Rosin B., N. Y. .....bbl.	8.25
Rosin F., N. Y. .....bbl.	8.25
Rosin B.† .....bbl.	6.80
Rosin F.† .....bbl.	6.80
Rosin Oil 1st run.....gal.	.48
Rosin Oil 2nd run.....gal.	.51

Pine Tar—

Kiln Burnt .....bbl.	13.50
Retort . .....bbl.	13.50

*Nominal.
†Savannah, Ga., market.



"Better Than a Steam Rig"

That is what the men who have used both have to say about the *Bessemer 45* Drilling Engine. It does the work faster. It is cheaper to operate. It is easier to transport. Each of these facts makes for lower drilling cost.

The *Bessemer 45* consists of a two cylinder enclosed crankcase gas engine and special drilling clutch. The engine is built with crosshead construction, exceptionally heavy reinforced bed, forged steel crankshaft, extra large, easily adjustable bearings, *cast steel* fly wheels and combination improved force-feed and splash lubrication.

The clutch is smooth running and noiseless and built to stand the hard service required of a drilling engine. It uses six large friction shoes with large clearance, has split hub clutch spider, machine-cut steel gears and phosphor bronze bushed bearings.

The complete unit permits unusual drilling economy and will stand the toughest kind of field service.

THE BESSEMER GAS ENGINE COMPANY
18 York Street ⁘ ⁘ Grove City, Pa.

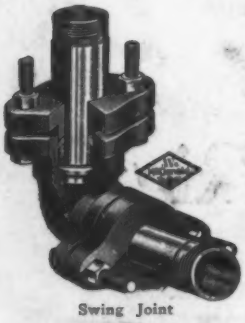
BESSEMER

BESSEMER OIL FIELD ENGINES – COMPRESSORS VACUUM PUMPS – ROLLER PUMPING POWERS

REFINERS! NEED ANY OF THESE?

Improved Foot Valve

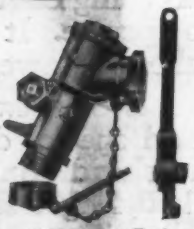
Handy Union Wrench Coupling



Swing Joint

Patented Dup'ex Tank Vent

Hand and Power Pumps and Pump Combinations



Self-Closing Tank Wagon Faucet

Combined Tank Wagon Cap and Vent

Lock Gate Valve

Put Bulk Stations In Shape For a RECORD Year

Consumption of Petroleum Products will again take a leap forward in 1925. The refiner whose bulk stations are "prepared" will get the lion's share of the advance.

Leaky valves should be replaced. Evaporation losses should be cut short with proper vents. Efficient pumps—modern tank wagon vents and faucets—all these details should be attended to.

Then your men can forget petty annoyances and concentrate, when the busy season opens, on their "primary job"—getting the business which will make 1925 your RECORD year.

The World's largest manufacturer of oil handling equipment is ready to serve you.

"The Home of the Swing Joint"

A. Y. McDONALD MFG. CO.

DUBUQUE, IOWA

OMAHA MINNEAPOLIS DES MOINES

Complete stocks also carried by:

Butler Mfg. Co., Kansas City.

Preferred Utilities Co., 33 W. 60th St., New York

U. S. Flexible Metallic Tubing Co., San Francisco, Seattle, Los Angeles

EST 1856 McDonald

McDONALD